This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

Boston Transit Commission.

Seventh Annual Report.

SICUT PATRIBUS SIT DEUS NOBIS
BOSTONIA
CONDITA AD.
1630.
CIVITATIS REGIMINE DONATA AD. 1822

August 15, 1901.

HE
4491
B65.1
1901
c.2

HARVARD UNIVERSITY

LIBRARY OF THE SCHOOLS OF
LANDSCAPE ARCHITECTURE
AND
CITY PLANNING

8354

J. S. Pray

SEVENTH ANNUAL REPORT

OF THE

BOSTON TRANSIT COMMISSION,

FROM

THE BOSTON TRANSIT COMMISSION,
20 Beacon Street.

GEORGE G. CROCKER, *Chairman,*

CHARLES H. DALTON,
THOMAS J. GARGAN,
GEORGE F. SWAIN,
HORACE G. ALLEN,
Commissioners.

HOWARD A. CARSON,
Chief Engineer.

B. LEIGHTON BEAL,
Secretary.

BOSTON:
ROCKWELL AND CHURCHILL PRESS.
1901

Feb. 1, 1932

HARVARD UNIVERSITY
The Library of the Schools
of Landscape Architecture and City Planning

Gift of B. Pray from
collection J. S. Pray

7219

HE
4491
B55.1
[illegible]

Feb. 1, 1932

HARVARD UNIVERSITY
The Library of the Schools
of Landscape Architecture and City Planning

Gift of B. Pray from
collection J. S. Pray

7219

HE
4491
B65.1
1901
c.2

BOSTON TRANSIT COMMISSION.

---

20 Beacon Street,
Boston, Aug. 15, 1901.

To the City Council of the City of Boston:

In compliance with Statutes of 1894, chapter 548, section 24, the report of the Boston Transit Commission for the year ending Aug. 15, 1901, is respectfully submitted.

Subway.

During the year expenses on the subway have amounted to about $2,100, of which more than one half was for the construction of a pipe sewer under the Common to carry away water which, during storms, collected around the entrances to the Boylston-street station, and for work done in consequence of the break in the thirty-inch water-main on Tremont street in August, 1900. This expenditure was for new construction.

Use of Third Rail in the Subway.

Prior to the preparation of the last annual report a communication had been sent to the Boston Elevated Railway Company in relation to methods to be adopted to obviate or minimize the danger from the third rail in the subway. A reply to that communication was received in November as follows:

President's Office,
101 Milk Street, Boston, Mass., Nov. 12, 1900.

The Hon. George G. Crocker, *Chairman, Boston Transit Commission, 20 Beacon Street, Boston, Mass.:*

Dear Sir: In response to your letter of June 28 of the current year, saying that "the Commission would like to be informed as to what method you propose to adopt to obviate or minimize the danger from the third rail in the subway," I regret that I have not been able earlier to give you the information desired.

Several methods have been suggested and proposed to the Honorable Board of Railroad Commissioners under the law, for the approval of that Board. That Board, however, has but just given its consent to the method proposed. I send herewith blue-prints, showing the method as approved by the Board of Railroad Commissioners. It is understood, I suppose, that the manner of use will be the usual one of a shoe, so-called, coming in contact with the third rail. The blue-prints show the method of guarding the third rail.

Respectfully,

(Signed) WM. A. BANCROFT,
President.

This proposed method of guarding the third rail did not commend itself to the Commission. The Chief Engineer was thereupon requested to confer with officials of the road as to additional protection and as to the feasibility of using other methods of propulsion for elevated trains in the subway. Later the following communication was received from the company:

PRESIDENT'S OFFICE,
101 MILK STREET, BOSTON, MASS., NOV. 23, 1900.

HON. GEORGE G. CROCKER, *Chairman, Boston Transit Commission, 20 Beacon Street, Boston, Mass.:*

DEAR MR. CHAIRMAN: Without wishing to be intrusive, I ask permission to call your attention to the necessity which exists of learning what form of guard we are to use with the third rail on the elevated lines. Not only is the contract for the guard held in abeyance, but the construction of the car trucks is also, until we hear from your Board. The urgency of this matter is presented to me almost daily by the officials of our company immediately concerned, and if it is feasible for your Board to take early action, I shall be very glad; for it will be of great assistance to us in getting ready to operate the elevated lines.

Respectfully,

(Signed) WM. A. BANCROFT,
President.

To this the Commission replied as follows:

BOSTON TRANSIT COMMISSION,
20 BEACON STREET, BOSTON, NOV. 27, 1900.

WILLIAM A. BANCROFT, Esq., *President Boston Elevated Railway Company:*

DEAR SIR: Your letter of the 23d inst., requesting early action by this Commission in relation to the method of protection of the third rail in the subway was duly received..

We respectfully call your attention to the fact that by letter under date of the 28th June last we inquired what method you proposed to adopt. It was not until the 12th inst., that we received a communication with a blue print showing the method approved by the Railroad Commissioners.

We recognize that there is a question whether the legislation of 1897 has not removed from us the responsibility as to this matter which rested upon us under the contract with the West End Street Railway for the use of the subway, but if such responsibility still exists we hereby notify you that the particular method of protecting the third rail submitted to us by your communication of the 12th inst., does not meet with our approval.

By order of the Boston Transit Commission,
(Signed) GEORGE G. CROCKER,
Chairman.

On November 30 a conference was held with officials of the Boston Elevated Railway Company with reference to the attitude of the Commission as to the third rail and guard therefor. The company took the ground that the clause in the Act of 1897 which (section 6, chapter 500) required the Board of Railroad Commissioners to examine the plans of the company " with reference to the rolling stock, motive power and method of operation and with reference to the convenience and comfort of the public," and when such plans were satisfactory to that Board to give a certificate approving the same, superseded the clause in the lease of the subway to the West End Street Railway Company, which was signed in December, 1896, requiring the approval of this Commission as to the manner of use of any motive power, but that if this Commission claimed jurisdiction in the premises, that jurisdiction would not be disputed. Thereupon the following vote was passed:

Voted, That the opinion of the Corporation Counsel be requested upon the following: — The Boston Elevated Railway Company proposes to adopt the third rail system for the operation of its elevated service within the subway, and its equipment therefor and guard for said rail have been submitted to and have received the approval of the Board of Railroad Commissioners. Is it part of the power and duty of this Commission to approve or disapprove of said third rail and the method of guarding the same?

In December the Chairman reported that the Corporation Counsel had given an oral opinion that the powers of the Commission under the contract for the use of the subway were not affected by the legislation of 1897. This fact was stated to the company in the following communication:

BOSTON TRANSIT COMMISSION,
20 BEACON STREET, BOSTON, Dec. 13, 1900.

BOSTON ELEVATED RAILWAY COMPANY, WILLIAM A. BANCROFT, *President:*

DEAR SIR: Further consideration confirms this Commission in the opinion that the method of guarding the third rail in the subway is subject to its approval. This view of the power and duty of the Commission is confirmed by an oral opinion of the Corporation Counsel this day given.

Yours very truly,
(Signed) GEORGE G. CROCKER,
Chairman.

After conferences both with the Board of Railroad Commissioners and with the officials of the Boston Elevated Railway Company, the following was submitted by the company on December 18, and was approved by both Boards:

LOCATION AND PROTECTION OF THIRD RAIL IN SUBWAY.

1. *Location:* In such portions of the subway as are occupied by tracks for both surface and elevated cars, the third rail to be located on that side of the subway furthest from the surface car tracks; at stations, to be located on the side furthest from the platform. In subway occupied by two elevated tracks, the third rails to be located between the tracks.

2. *Protection:* The form of protection, or guard, which is deemed by the railway company best suited for use in the subway is in the nature of a sheath of thin board, fastened to the side of the rail, thus protecting against any contact except on top of the rail, this sheath to be painted white and plainly lettered "Danger, Live Rail." It is believed that this sheath, combined with the location of the rail as above described in points where no temptation exists to walk upon it, will be a better protection than the setting up of any raised guard, which would increase the difficulty of getting over the rail, and would seriously imperil those whose duties required them to be upon these tracks.

At all points where not already provided, a foot-walk to be built on the side furthest from the third rail.

DEC. 18, 1900.
CSS:P.

(See Plate A.)

Later the company made the following application, which was granted, for a change in the location of the third rail in certain portions of the subway and permission to erect a fence in connection therewith:

PRESIDENT'S OFFICE.
101 MILK STREET, BOSTON, MASS., Feb. 20, 1901.

THE BOSTON TRANSIT COMMISSION, GEO. G. CROCKER, *Chairman*,
20 Beacon Street, Boston:

DEAR SIR: We hereby request your Honorable Board to approve the erection of fence and change of location of third rail from plans originally approved in those portions of the subway used in common by surface and elevated cars, as shown by blue prints of plans of George A. Kimball, Chief Engineer, No. 20908 and 20909.

Yours truly,
(Signed) WM. A. BANCROFT,
President.

The plans named in the communication are shown on Plate B.

Break in 30-inch Water-main under Tremont Street, near the Corner of Boylston Street.

After investigation it appears to the Commission that it is not responsible for the accident to the thirty-inch water-main in Tremont street near Boylston, on Aug. 8, 1900.

PLATE A

SEVENTH ANNUAL REPORT

OF THE

BOSTON TRANSIT COMMISSION,

FROM

THE BOSTON TRANSIT COMMISSION,
20 Beacon Street.

GEORGE G. CROCKER, *Chairman,*

CHARLES H. DALTON,
THOMAS J. GARGAN,
GEORGE F. SWAIN,
HORACE G. ALLEN,
Commissioners.

HOWARD A. CARSON,
Chief Engineer.

B. LEIGHTON BEAL,
Secretary.

BOSTON:
ROCKWELL AND CHURCHILL PRESS.
1901

SEVENTH ANNUAL REPORT

OF THE

BOSTON TRANSIT COMMISSION,

FOR THE YEAR ENDING

AUGUST 15, 1901.

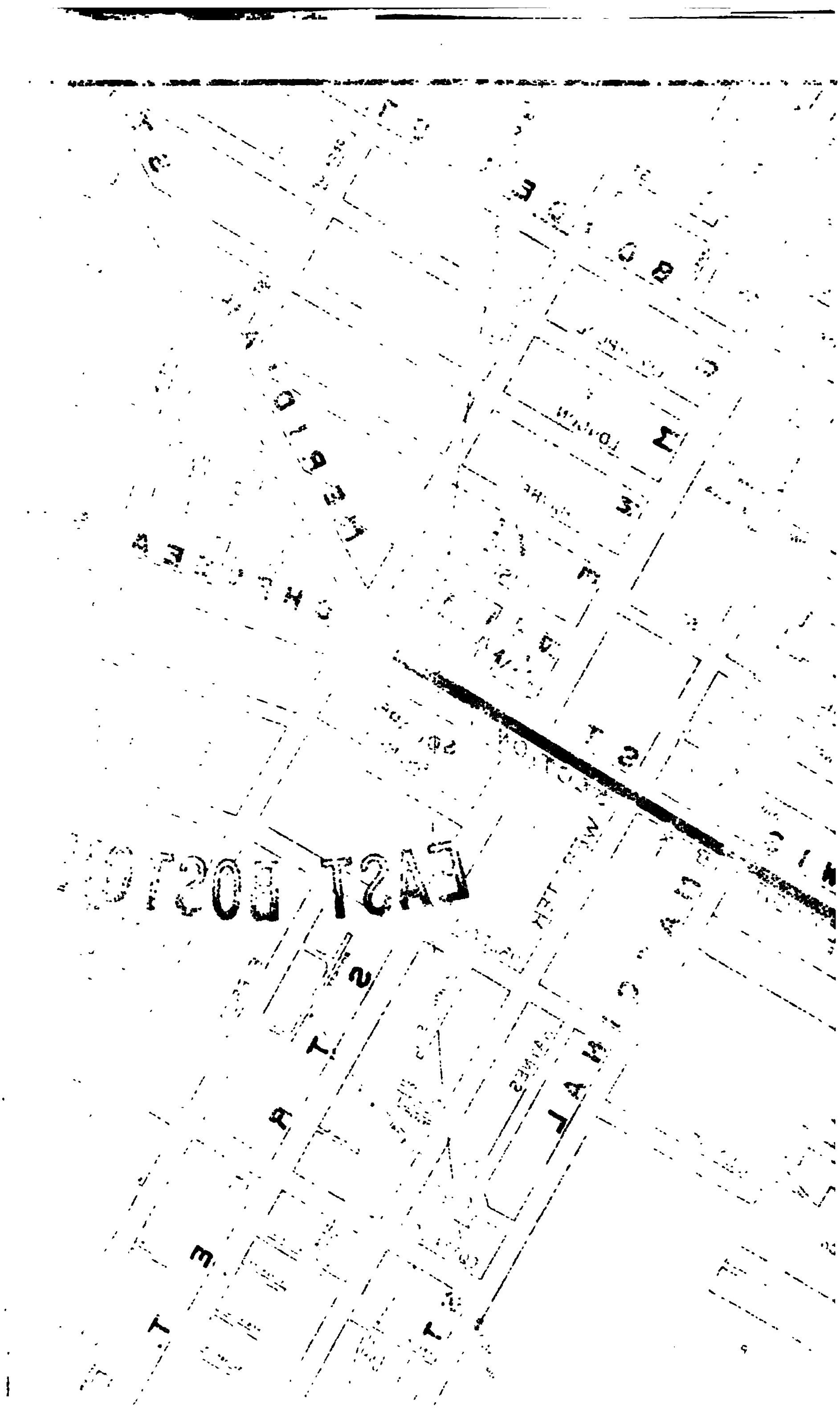
BOSTON:
ROCKWELL AND CHURCHILL PRESS.
1901

Feb. 1, 1932

HARVARD UNIVERSITY
The Library of the Schools
of Landscape Architecture and City Planning

Gift of B. Pray from
collection J. S. Pray
7219

HE
4491
B65.1
1901


EAST BOSTON
MERIDIAN
CHELSEA

under the Charlestown end of the new bridge to Charlestown, and notified the Street Department to hereafter consider the said store as in charge of that department.

Respectfully,

(Signed) THOMAS N. HART, Ma

May 28 permission was granted to the Bunker Hill Ch ter, Daughters of the American Revolution, to place a ta commemorative of Paul Revere's ride on the left-hand of the entrance to the bridge from Warren avenue.

The work remaining to be done on the bridge consist the building of galleries around the draw piers to facili access to the hydraulic jacks and the building of a fl of steps from the roadway of the bridge to the public l ing at the Boston end of the old Charles-river bridge. construction of the galleries is awaiting the settlement o machinists' strike.

There are some claims for damages still unsettled.

The cost of the bridge to date has been $1,552,536.

SINKING FUNDS.

The following is the condition of the debt and si funds for the various appropriations for the work o Commission, at the date of this report:

SUBWAY (INCLUDING ALTERATIONS).

(*Debt, $4,415,000, outside debt limit.*)

Amount of fund, Aug. 15, 1900	$392,
Interest on bank deposits, Aug. 15, 1900, to date	1,
Interest on investments, Aug. 15, 1900, to date	12,
Revenue received, Aug. 15, 1900, to date	61,
	$46

CHARLESTOWN BRIDGE, NO. 1.

(*Debt, $750,000, inside debt limit.*)

Amount of fund, Aug. 15, 1900	$4
Interest on bank deposits, Aug. 15, 1900, to date	
Interest on investments, Aug. 15, 1900, to date	
Revenue received, Aug. 15, 1900, to date	
Requirement for debt	
	$

CHARLESTOWN BRIDGE, NO. 2.

(*Debt, [illegible], outside debt limit.*)

Amount of fund, Aug. 15, 1900	$
Interest on bank deposits, Aug. 15, 1900, to date	
Interest on investments, Aug. 15, 1900, to date	
Requirement for debt	
	$

Debt issued during the year	$10,000 00
" cancelled during the year	10,000 00

EAST BOSTON TUNNEL.

(Debt, $335,000, outside debt limit.)

No fund.

AMOUNTS PAID FOR RENTAL OF THE SUBWAY.

The following sums have been paid during the year by the Boston Elevated Railway Company for the use of the subway:

Oct. 1, 1900:		
Net cost of subway	$4,136,593 70	
One quarter's rental		$50,414 74
Alterations: total cost	201,898 38	
One quarter's rental		2,460 64
Jan. 1, 1901:		
Net cost of subway	4,137,027 78	
One quarter's rental		50,420 03
Alterations: total cost	223,704 77	
One quarter's rental		2,726 40
April 1, 1901:		
Net cost of subway	4,138,377 41	
One quarter's rental		50,436 48
Alterations: total cost	233,230 76	
One quarter's rental		2,842 50
July 1, 1901:		
Net cost of subway	4,138,405 91	
One quarter's rental		50,436 82
Alterations: total cost	240,301 77	
One quarter's rental		2,928 68
Total		$212,666 29

STATEMENT OF EXPENSES.

The following is a classified statement of the expenses of the Commission for the year ending Aug. 15, 1901:

SUBWAY.

General expenses:		
Stenographers	$124 04	
Clerks	16 00	
Messenger	9 00	
Total		$149 04

ENGINEERING DEPARTMENT.

Rooms — Supplies	$34 75	
Stationery and printing	241 23	
Legal and expert advice	6 00	
Stenographers	2 13	
Carried forward	$284 11	$149 04

under the Charlestown end of the new bridge to Charlestown, and have notified the Street Department to hereafter consider the said storehouses as in charge of that department.

Respectfully,

(Signed) THOMAS N. HART,
Mayor.

May 28 permission was granted to the Bunker Hill Chapter, Daughters of the American Revolution, to place a tablet commemorative of Paul Revere's ride on the left-hand side of the entrance to the bridge from Warren avenue.

The work remaining to be done on the bridge consists of the building of galleries around the draw piers to facilitate access to the hydraulic jacks and the building of a flight of steps from the roadway of the bridge to the public landing at the Boston end of the old Charles-river bridge. The construction of the galleries is awaiting the settlement of the machinists' strike.

There are some claims for damages still unsettled.

The cost of the bridge to date has been $1,552,536.43.

SINKING FUNDS.

The following is the condition of the debt and sinking funds for the various appropriations for the work of the Commission, at the date of this report:

SUBWAY (INCLUDING ALTERATIONS).

(*Debt, $4,415,000, outside debt limit.*)

Amount of fund, Aug, 15, 1900	$392,630 25
Interest on bank deposits, Aug. 15, 1900, to date	1,529 07
Interest on investments, Aug. 15, 1900, to date	12,520 00
Revenue received, Aug. 15, 1900, to date	61,378 25
	$468,057 57

CHARLESTOWN BRIDGE, NO. 1.

(*Debt, $750,000, inside debt limit.*)

Amount of fund, Aug. 15, 1900	$49,960 23
Interest on bank deposits, Aug. 15, 1900, to date	236 40
Interest on investments, Aug. 15, 1900, to date	1,467 00
Revenue received. Aug. 15, 1900, to date	900 00
Requirement for debt	8,847 00
	$61,410 63

CHARLESTOWN BRIDGE, NO. 2.

(*Debt, $800,000, outside debt limit.*)

Amount of fund, Aug, 15, 1900	$65,648 51
Interest on bank deposits, Aug. 15, 1900, to date	367 06
Interest on investments, Aug. 15, 1900, to date	1,615 00
Requirement for debt	6,700 00
	$74,330 57

Debt issued during the year	$10,000 00
" cancelled during the year	10,000 00

EAST BOSTON TUNNEL.

(Debt, $335,000, outside debt limit.)

No fund.

AMOUNTS PAID FOR RENTAL OF THE SUBWAY.

The following sums have been paid during the year by the Boston Elevated Railway Company for the use of the subway:

Oct. 1, 1900:		
Net cost of subway	$4,136,593 70	
One quarter's rental		$50,414 74
Alterations: total cost	201,898 38	
One quarter's rental		2,460 64
Jan. 1, 1901:		
Net cost of subway	4,137,027 78	
One quarter's rental		50,420 03
Alterations: total cost	223,704 77	
One quarter's rental		2,726 40
April 1, 1901:		
Net cost of subway	4,138,377 41	
One quarter's rental		50,436 48
Alterations: total cost	233,230 76	
One quarter's rental		2,842 50
July 1, 1901:		
Net cost of subway	4,138,405 91	
One quarter's rental		50,436 82
Alterations: total cost	240,301 77	
One quarter's rental		2,928 68
Total		$212,666 29

STATEMENT OF EXPENSES.

The following is a classified statement of the expenses of the Commission for the year ending Aug. 15, 1901:

SUBWAY.

General expenses:		
Stenographers	$124 04	
Clerks	16 00	
Messenger	9 00	
Total		$149 04

ENGINEERING DEPARTMENT.

Rooms — Supplies	$34 75	
Stationery and printing . . .	241 23	
Legal and expert advice	6 00	
Stenographers	2 13	
Carried forward	$284 11	$149 04

under the Charlestown end of the new bridge to Charlestown, and have notified the Street Department to hereafter consider the said storehouses as in charge of that department.

Respectfully,

(Signed) THOMAS N. HART,
Mayor.

May 28 permission was granted to the Bunker Hill Chapter, Daughters of the American Revolution, to place a tablet commemorative of Paul Revere's ride on the left-hand side of the entrance to the bridge from Warren avenue.

The work remaining to be done on the bridge consists of the building of galleries around the draw piers to facilitate access to the hydraulic jacks and the building of a flight of steps from the roadway of the bridge to the public landing at the Boston end of the old Charles-river bridge. The construction of the galleries is awaiting the settlement of the machinists' strike.

There are some claims for damages still unsettled.

The cost of the bridge to date has been $1,552,536.43.

SINKING FUNDS.

The following is the condition of the debt and sinking funds for the various appropriations for the work of the Commission, at the date of this report:

SUBWAY (INCLUDING ALTERATIONS).

(*Debt, $4,415,000, outside debt limit.*)

Amount of fund, Aug, 15, 1900	$392,630 25
Interest on bank deposits, Aug. 15, 1900, to date	1,529 07
Interest on investments, Aug. 15, 1900, to date	12,520 00
Revenue received, Aug. 15, 1900, to date	61,378 25
	$468,057 57

CHARLESTOWN BRIDGE, NO. 1.

(*Debt, $750,000, inside debt limit.*)

Amount of fund, Aug. 15, 1900	$49,960 23
Interest on bank deposits, Aug. 15, 1900, to date	236 40
Interest on investments, Aug. 15, 1900, to date	1,467 00
Revenue received. Aug. 15, 1900, to date	900 00
Requirement for debt	8,847 00
	$61,410 63

CHARLESTOWN BRIDGE, NO. 2.

(*Debt, $800,000, outside debt limit.*)

Amount of fund, Aug, 15, 1900	$65,648 51
Interest on bank deposits, Aug. 15, 1900, to date	367 06
Interest on investments, Aug. 15, 1900, to date	1,615 00
Requirement for debt	6,700 00
	$74,330 57

Debt issued during the year	$10,000 00
" cancelled during the year	10,000 00

EAST BOSTON TUNNEL.

(*Debt, $335,000, outside debt limit.*)

No fund.

AMOUNTS PAID FOR RENTAL OF THE SUBWAY.

The following sums have been paid during the year by the Boston Elevated Railway Company for the use of the subway:

Oct. 1, 1900:		
Net cost of subway	$4,136,593 70	
One quarter's rental		$50,414 74
Alterations: total cost	201,898 38	
One quarter's rental		2,460 64
Jan. 1, 1901:		
Net cost of subway	4,137,027 78	
One quarter's rental		50,420 03
Alterations: total cost	223,704 77	
One quarter's rental		2,726 40
April 1, 1901:		
Net cost of subway	4,138,377 41	
One quarter's rental		50,436 48
Alterations: total cost	233,230 76	
One quarter's rental		2,842 50
July 1, 1901:		
Net cost of subway	4,138,405 91	
One quarter's rental		50,436 82
Alterations: total cost	240,301 77	
One quarter's rental		2,928 68
Total		$212,666 29

STATEMENT OF EXPENSES.

The following is a classified statement of the expenses of the Commission for the year ending Aug. 15, 1901:

SUBWAY.

General expenses:		
Stenographers	$124 04	
Clerks	16 00	
Messenger	9 00	
Total		$149 04

ENGINEERING DEPARTMENT.

Rooms — Supplies	$34 75	
Stationery and printing	241 23	
Legal and expert advice	6 00	
Stenographers	2 13	
Carried forward	$284 11	$149 04

under the Charlestown end of the new bridge to Charlestown, and have notified the Street Department to hereafter consider the said storehouses as in charge of that department.

Respectfully,

(Signed) THOMAS N. HART,
Mayor.

May 28 permission was granted to the Bunker Hill Chapter, Daughters of the American Revolution, to place a tablet commemorative of Paul Revere's ride on the left-hand side of the entrance to the bridge from Warren avenue.

The work remaining to be done on the bridge consists of the building of galleries around the draw piers to facilitate access to the hydraulic jacks and the building of a flight of steps from the roadway of the bridge to the public landing at the Boston end of the old Charles-river bridge. The construction of the galleries is awaiting the settlement of the machinists' strike.

There are some claims for damages still unsettled.

The cost of the bridge to date has been $1,552,536.43.

SINKING FUNDS.

The following is the condition of the debt and sinking funds for the various appropriations for the work of the Commission, at the date of this report:

SUBWAY (INCLUDING ALTERATIONS).

(Debt, $4,415,000, outside debt limit.)

Amount of fund, Aug, 15, 1900	$392,630 25
Interest on bank deposits, Aug. 15, 1900, to date	1,529 07
Interest on investments, Aug. 15, 1900, to date	12,520 00
Revenue received, Aug. 15, 1900, to date	61,378 25
	$468,057 57

CHARLESTOWN BRIDGE, NO. 1.

(Debt, $750,000, inside debt limit.)

Amount of fund, Aug. 15, 1900	$49,960 23
Interest on bank deposits, Aug. 15, 1900, to date	236 40
Interest on investments, Aug. 15, 1900, to date	1,467 00
Revenue received. Aug. 15, 1900, to date	900 00
Requirement for debt	8,847 00
	$61,410 63

CHARLESTOWN BRIDGE, NO. 2.

(Debt, $800,000, outside debt limit.)

Amount of fund, Aug, 15, 1900	$65,648 51
Interest on bank deposits, Aug. 15, 1900, to date	367 06
Interest on investments, Aug. 15, 1900, to date	1,615 00
Requirement for debt	6,700 00
	$74,330 57

Debt issued during the year	$10,000 00
" cancelled during the year	10,000 00

EAST BOSTON TUNNEL.

(Debt, $335,000, outside debt limit.)

No fund.

AMOUNTS PAID FOR RENTAL OF THE SUBWAY.

The following sums have been paid during the year by the Boston Elevated Railway Company for the use of the subway:

Oct. 1, 1900:		
Net cost of subway	$4,136,593 70	
One quarter's rental		$50,414 74
Alterations: total cost	201,898 38	
One quarter's rental		2,460 64
Jan. 1, 1901:		
Net cost of subway	4,137,027 78	
One quarter's rental		50,420 03
Alterations: total cost	223,704 77	
One quarter's rental		2,726 40
April 1, 1901:		
Net cost of subway	4,138,377 41	
One quarter's rental		50,436 48
Alterations: total cost	233,230 76	
One quarter's rental		2,842 50
July 1, 1901:		
Net cost of subway	4,138,405 91	
One quarter's rental		50,436 82
Alterations: total cost	240,301 77	
One quarter's rental		2,928 68
Total		$212,666 29

STATEMENT OF EXPENSES.

The following is a classified statement of the expenses of the Commission for the year ending Aug. 15, 1901:

SUBWAY.

General expenses:		
Stenographers	$124 04	
Clerks	16 00	
Messenger	9 00	
Total		$149 04

ENGINEERING DEPARTMENT.

Rooms — Supplies	$34 75	
Stationery and printing	241 23	
Legal and expert advice	6 00	
Stenographers	2 13	
Carried forward	$284 11	$149 04

under the Charlestown end of the new bridge to Charlestown, and have notified the Street Department to hereafter consider the said storehouses as in charge of that department.

Respectfully,

(Signed) THOMAS N. HART,
Mayor.

May 28 permission was granted to the Bunker Hill Chapter, Daughters of the American Revolution, to place a tablet commemorative of Paul Revere's ride on the left-hand side of the entrance to the bridge from Warren avenue.

The work remaining to be done on the bridge consists of the building of galleries around the draw piers to facilitate access to the hydraulic jacks and the building of a flight of steps from the roadway of the bridge to the public landing at the Boston end of the old Charles-river bridge. The construction of the galleries is awaiting the settlement of the machinists' strike.

There are some claims for damages still unsettled.

The cost of the bridge to date has been $1,552,536.43.

SINKING FUNDS.

The following is the condition of the debt and sinking funds for the various appropriations for the work of the Commission, at the date of this report:

SUBWAY (INCLUDING ALTERATIONS).

(Debt, $4,415,000, outside debt limit.)

Amount of fund, Aug, 15, 1900	$392,630 25
Interest on bank deposits, Aug. 15, 1900, to date	1,529 07
Interest on investments, Aug. 15, 1900, to date	12,520 00
Revenue received, Aug. 15, 1900, to date	61,378 25
	$468,057 57

CHARLESTOWN BRIDGE, NO. 1.

(Debt, $750,000, inside debt limit.)

Amount of fund, Aug. 15, 1900	$49,960 23
Interest on bank deposits, Aug. 15, 1900, to date	236 40
Interest on investments, Aug. 15, 1900, to date	1,467 00
Revenue received, Aug. 15, 1900, to date	900 00
Requirement for debt	8,847 00
	$61,410 63

CHARLESTOWN BRIDGE, NO. 2.

(Debt, $800,000, outside debt limit.)

Amount of fund, Aug, 15, 1900	$65,648 51
Interest on bank deposits, Aug. 15, 1900, to date	367 06
Interest on investments, Aug. 15, 1900, to date	1,615 00
Requirement for debt	6,700 00
	$74,330 57

Debt issued during the year	$10,000 00
" cancelled during the year	10,000 00

EAST BOSTON TUNNEL.

(Debt, $335,000, outside debt limit.)

No fund.

AMOUNTS PAID FOR RENTAL OF THE SUBWAY.

The following sums have been paid during the year by the Boston Elevated Railway Company for the use of the subway:

Oct. 1, 1900:		
Net cost of subway	$4,136,593 70	
One quarter's rental		$50,414 74
Alterations: total cost	201,898 38	
One quarter's rental		2,460 64
Jan. 1, 1901:		
Net cost of subway	4,137,027 78	
One quarter's rental		50,420 03
Alterations: total cost	223,704 77	
One quarter's rental		2,726 40
April 1, 1901:		
Net cost of subway	4,138,377 41	
One quarter's rental		50,436 48
Alterations: total cost	233,230 76	
One quarter's rental		2,842 50
July 1, 1901:		
Net cost of subway	4,138,405 91	
One quarter's rental		50,436 82
Alterations: total cost	240,301 77	
One quarter's rental		2,928 68
Total		$212,666 29

STATEMENT OF EXPENSES.

The following is a classified statement of the expenses of the Commission for the year ending Aug. 15, 1901:

SUBWAY.

General expenses:		
Stenographers	$124 04	
Clerks	16 00	
Messenger	9 00	
Total		$149 04

ENGINEERING DEPARTMENT.

Rooms — Supplies	$34 75	
Stationery and printing	241 23	
Legal and expert advice	6 00	
Stenographers	2 13	
Carried forward	$284 11	$149 04

Brought forward	$284 11	$149 04
Labor	8 40	
Skilled service	89 03	
Total		381 54

SECTION ONE.

Labor	$1 65	1 65

SECTION TWO.

Construction	$578 87	
Labor	34 31	
Messenger	1 64	
Stenographers	8 54	
Office supplies	1 00	
Field supplies	8 05	
Skilled service	86 44	
		718 85

SECTION THREE.

Labor	$126 50	
Skilled service	5 00	
Field supplies	27 40	
		158 90

SECTION FOUR.

Labor	$258 20	
Field supplies	56 27	
Office supplies	20 86	
Messenger	5 34	
Stenographers	6 41	
Skilled service	100 00	
Teaming	11 03	
Construction	18 00	
		476 11

SECTION FIVE.

Labor	$0 70	70

SECTION SIX.

Labor	$2 25	
Damages	65 00	
		67 25

SECTION SEVEN.

Labor	$2 45	2 45

SECTION EIGHT.

Office supplies	$1 45	
Field supplies	3 15	
Labor	40 65	
		45 25

SECTION NINE.

Labor	$7 00	7 00
Carried forward		$2,008 74

Brought forward		$2,008 74

SECTION TEN.

Labor	$2 45	
Field supplies	40 00	
		42 45

SECTION ELEVEN.

Construction	$60 75	
Labor	87	
Clerks	1 15	
Skilled service	15 70	
		78 47

ALTERATIONS.

(*Made upon request of Boston Elevated Railway Company, as authorized by Chapter 500, Acts of 1897.*)

General Expenses:		
Amount transferred from East Boston tunnel general expenses	$4,449 47	
Proportion of salary of Chief Engineer	1,624 74	
Stationery and printing	69 72	
Office supplies	15	
Labor	16 00	
		6,160 08

SECTION THREE.

Skilled service	$40 00	40 00

SECTION FIVE.

Patrick McGovern	$26,423 53	
Construction	541 73	
Advertising	73 41	
Office supplies	35 68	
Field supplies	53 23	
Stationery and printing	127 67	
Labor	905 96	
Inspection	42 73	
Skilled service	931 41	
Messenger	18 04	
Stenographers	51 25	
Teaming	15 12	
Water-pipes	412 47	
		29,632 23

SECTION SEVEN.

(*Sub-passageways under tracks, Scollay square.*)

Metropolitan Contracting Company	$3,133 55	
Construction	2,600 31	
Office supplies	11 39	
Field supplies	79 69	
Inspection	5 70	
Labor	220 31	
Messenger	9 85	
Stenographers	35 48	
Skilled service	740 42	
Teaming	6 00	
		6,842 70
Carried forward		$44,804 67

Brought forward			$44,804 67

EAST BOSTON TUNNEL.

General Expenses:			
Office — Repairs		$49 96	
Furniture		87 00	
Supplies		540 03	
Stationery and printing		198 39	
Fuel and light		154 20	
Rental		1,500 00	
Stenographers		3,056 43	
Messenger		927 00	
Clerks		813 71	
Janitor		269 10	
Salaries of Commissioners and Secretary,		28,000 00	
		$35,595 82	
Transferred to other accounts:			
Charlestown Bridge	$2,615 64		
Alterations	4,449 47		
		7,065 11	
Balance General Expenses; East Boston Tunnel		$28,530 71	
Proportion of salary of Chief Engineer		6,707 26	
			35,237 97

ENGINEERING DEPARTMENT.

Rooms — Repairs	$9 30	
Furniture	5 75	
Supplies	508 62	
Stationery and printing	1,152 35	
Fuel and light	170 39	
Rental	1,500 00	
Janitor	269 10	
Messenger	559 85	
Stenographers	1,474 12	
Clerks	1 14	
Instruments	34 85	
Skilled service	13,115 55	
	$18,801 02	
Less stock transferred to various sections	8 55	
		18,792 47

MISCELLANEOUS.

Labor	$265 94	
E. A. Clark, borings	4,974 86	
Teaming	75	
		5,241 55

SECTION A.

(*In Maverick square and Lewis street, East Boston, to a point 100 feet southwest of Webster street.*)

National Contracting Company	$59,287 12	
Office supplies	126 27	
Field supplies	459 80	
Construction	3,497 75	
Carried forward	$63,370 94	$104,076 66

Brought forward	$63,370 94	$104,076 66
Labor	37 61	
Teaming	12 25	
Rental	45 00	
Skilled service	26 11	
Inspection	288 80	
Legal and expert advice	115 00	
Water-pipes	16 21	
	$63,911 92	
Less transferred to general office supplies, East Boston tunnel	15 00	
		63,896 92

SECTION B.

(*From a point in Lewis street 100 feet southwest of Webster street, East Boston, under harbor between South Ferry slip on the East Boston side and Long wharf on the Boston side, State street.*)

Boston Tunnel Construction Company	$116,357 09	
Construction	10,195 36	
Office supplies	576 05	
Field supplies	1,248 66	
Advertising	13 13	
Labor	668 12	
Teaming	76 60	
Stationery and printing	39 00	
Legal and expert advice	1,115 50	
Skilled service	765 98	
Inspection	3,008 75	
Instruments	56 60	
Rental	105 00	
Water-pipes	499 89	
		134,725 73

CHARLESTOWN BRIDGE.

General Expenses:		
Transferred from East Boston Tunnel, General Expenses	$2,615 64	
Land damages	63,432 49	
Stationery and printing	1,752 42	
Construction	4,680 53	
Office supplies	203 83	
Field supplies	1,257 42	
Labor	1,421 77	
Legal and expert advice	100 00	
Teaming	134 00	
Grade damages	23,432 01	
Skilled service	222 28	
		99,252 39

INTEREST.

East Boston Tunnel	35,175 00
Grand Total	$437,126 70

SUMMARY.

	From beginning of work to Aug. [illegible]	Aug. [illegible], to Aug. [illegible]
Subway. — Subway Commission	[illegible]	
Part of General Expenses	[illegible]	[illegible]
Engineering and Miscellaneous	[illegible]	[illegible]
Section One	[illegible]	[illegible]
Two	[illegible]	[illegible]
Three	[illegible]	[illegible]
Three and one-half	[illegible]	
Four	[illegible]	[illegible]
Five	[illegible]	
Six	[illegible]	[illegible]
Seven	[illegible]	[illegible]
Eight	[illegible]	[illegible]
Eight and one-half	[illegible]	
Nine	[illegible]	[illegible]
Ten	[illegible]	[illegible]
Eleven	[illegible]	[illegible]
Interest	[illegible]	
Total	[illegible]	[illegible]
[illegible] — Part of General Expenses	[illegible]	[illegible]
Section One	[illegible]	[illegible]
Four	[illegible]	
Five	[illegible]	[illegible]
Seven	[illegible]	[illegible]
Nine	[illegible]	
Ten	[illegible]	
Interest	[illegible]	
Total	[illegible]	[illegible]
East Boston Tunnel. — Part of General Expenses	[illegible]	[illegible]
Engineering Expenses	[illegible]	[illegible]
Section 1	[illegible]	[illegible]
Section 3	[illegible]	[illegible]
Interest		[illegible]
Total	[illegible]	[illegible]
Bridge. — Part of General Expenses	[illegible]	[illegible]
Engineering Expenses	[illegible]	[illegible]
Total	[illegible]	[illegible]
Grand Total	[illegible]	[illegible]

[illegible]

The report of the Chief Engineer is appended.

On page 17 of the Sixth Annual Report it is stated that bonds to the amount of $200,000 were issued at 3 per cent. This is an error. No bonds on behalf of the Commission have been issued bearing interest at less than 3½ per cent.

The term of office of the Commission will expire July 1, 1902. The East Boston tunnel will not then be completed. June 15, 1903, is the date fixed by contract for the completion of the section under the harbor. Other sections are still to be contracted for. There are unsettled claims for damages resulting from the building of Charlestown bridge. To provide for the settlement of these claims, for the construction of the East Boston tunnel, and for the construction of the additional subways called for by the Act of 1897, further administrative agency must be created by legislation.

GEORGE G. CROCKER,
CHARLES H. DALTON,
THOMAS J. GARGAN,
GEORGE F. SWAIN,
HORACE G. ALLEN,
Boston Transit Commission.

SUMMARY.

	From beginning of work to Aug. 15, 1900.	Aug. 15, 1900, to Aug. 15, 1901.	Total.
Subway. — Subway Commission . . .	$14,131 16		$14,131 16
Part of General Expenses . . .	117,307 29	$149 04	117,456 33
Engineering and Miscellaneous . . .	406,252 47	381 54	406,634 01
Section One . . .	240,594 76	1 65	240,596 41
Two . . .	364,173 20	718 85	364,892 05
Three . .	307,910 63	158 90	308,069 53
Three and one-half . .	9,479 39		9,479 39
Four . .	476,110 31	476 11	476,586 42
Five . .	387,438 54	70	387,439 24
Six . . .	327,551 61	67 25	327,618 86
Seven . .	236,486 39	2 45	236,488 84
Eight . .	100,065 79	45 25	100,111 04
Eight and one-half . .	77,467 04		77,467 04
Nine . .	309,890 02	7 00	309,897 02
Ten . . .	257,358 89	42 45	257,401 34
Eleven . .	269,231 43	78 47	269,309 90
Interest . . .	258,575 60		258,575 60
Total	$4,160,024 52	$2.129 66	$4,162,154 18
Alterations. — Part of General Expenses .	$22,272 87	$6,160 08	$28,432 95
Section Three . .	2,528 26	40 00	2,568 26
Four . . .	163 42		163 42
Five . . .	597 98	29,632 23	30,230 21
Seven . .	173,271 29	6,842 70	180,113 99
Nine . .	3 00		3 00
Ten . . .	534 04		534 04
Interest . . .	1,905 56		1,905 56
Total . . .	$201,276 42	$42.675 01	$243,951 43
East Boston Tunnel. — Part of General Expenses . . .	$34,632 75	$35,237 97	$69,870 72
Engineering Expenses .	49,599 01	24,034 02	73,633 03
Section A . . .	29,754 18	[1]63,896 92	93,651 10
Section B . . .	732 08	134,725 73	135,457 81
Interest . . .		35,175 00	35,175 00
Total . . .	$114,718 02	$293.069 64	$407,787 66
Bridge. — Part of General Expenses . . .	$51,204 93	$2,615 64	$53,820 57
Engineering Expenses .	1,402,079 11	96,636 75	1,498,715 86
Total . . .	$1,453,284 04	$99,252 39	$1,552,536 43
Grand Total . .	$5,929,303 00	$437,126 70	$6,366,429 70

---

[1] See details on Section A above.

The report of the Chief Engineer is appended.

On page 17 of the Sixth Annual Report it is stated that bonds to the amount of $200,000 were issued at 3 per cent. This is an error. No bonds on behalf of the Commission have been issued bearing interest at less than 3½ per cent.

The term of office of the Commission will expire July 1, 1902. The East Boston tunnel will not then be completed. June 15, 1903, is the date fixed by contract for the completion of the section under the harbor. Other sections are still to be contracted for. There are unsettled claims for damages resulting from the building of Charlestown bridge. To provide for the settlement of these claims, for the construction of the East Boston tunnel, and for the construction of the additional subways called for by the Act of 1897, further administrative agency must be created by legislation.

GEORGE G. CROCKER,
CHARLES H. DALTON,
THOMAS J. GARGAN,
GEORGE F. SWAIN,
HORACE G. ALLEN,

Boston
Transit
Commission.

REPORT OF THE CHIEF ENGINEER.

BOSTON, Aug. 15, 1901.

GEORGE G. CROCKER, CHARLES H. DALTON, THOMAS J. GARGAN, GEORGE F. SWAIN, HORACE G. ALLEN, *Boston Transit Commissioners*:

GENTLEMEN: I herewith submit my report for the past year on the East Boston tunnel and on changes made in the subway. In view of the interest in the tunnel felt by the citizens of Boston, I have by your direction included some information given in preceding reports.

THE EAST BOSTON TUNNEL.

This tunnel was, after delays caused by legal proceedings, begun in May, 1900, and about one-fifth is now substantially completed. It is somewhat notable by reason of its size, its projected length under the harbor, and on account of the materials and manner of its construction. Its exterior diameter is about two feet greater and its interior diameter about one foot less than that of the Blackwall tunnel;* and its interior diameter is respectively fifteen and twenty per cent. greater than that of the St. Clair † and Hudson river tunnels. Its length under water is more than twice as great as that of the first named, and is considerably greater than that of the St. Clair or the shield-built portion of the Hudson river tunnel. The ground to be passed through is probably not much more nor much less difficult than the clay and silt portions of the tunnels named above. The Blackwall tunnel for a length of about four hundred feet passes through gravel much more difficult to tunnel through than anything thus far revealed on our work.

The East Boston tunnel walls, including the upper arch and the invert, have so far been made, and according to present indications, will in the main continue to be made, of fresh concrete, resulting in a monolithic structure. This is believed to be the first successful example of walls made of fresh concrete in connection with shield tunneling. In Paris concrete blocks resembling cut stone were used to some extent in tunneling for the underground roads, but the attempts there made to use fresh concrete with shields were not successful. To be on the safe side a provision was made in the contract for Section B for the use of

---

* Under the Thames, London.

† Between Port Huron, Mich., and Sarnia, P.O.

cast-iron segments (such as were used on the St. Clair and other tunnels mentioned above) at any places where the Engineer might deem it necessary, but considerable experiment and study of the question made it appear probable that little use would be required of them on our work. Soon after the contract was signed the contractors requested that the arch of the tunnel be made of cast-iron instead of concrete, they then doubting whether it would be practicable to make fresh concrete arches in connection with shield work. The request was refused. The Engineer was authorized, however, by the Commission to modify somewhat at the commencement of the work the proposed construction and to continue such modification so long as should be deemed expedient. According to the contract the arch was to be made in two concentric shells, and the shield was to be pushed forward by jacks re-acting against six-inch lagging on which the outer shell was to be built. As fast as the lagging for the outer shell was taken down it was to have an interior coat of rich cement mortar and the inner shell was to be built against it. The modification alluded to above was to allow the arch to be built of a single thick shell instead of two thin ones and to use cast-iron push rods (similar to those used on Section 6 of the Subway) imbedded in the arch for the jacks to push against instead of the lagging. A single thick shell is probably stronger than two concentric thin ones and can be built with considerably less labor. It may require some additional expedient to make it equally effective in resisting the entrance of water. It will be seen by reference to plates 8 and 11 that a roof-shield running on side-walls is used on Section B and that the whole scheme of tunneling there follows very closely the method used on Section 6 (see plate 21, 3d Annual Report) of the subway. An important difference is that in Section 6 the arch was made of brick.

The following memoranda may be of interest in this connection:

1892. Roof-shield to run on side walls unsuccessfully tried in Howard-street tunnel in Baltimore.

August, 1895, to October, 1896. Roof-shield running upon a track of wood and steel laid on the ground underlying the arch (not on the tunnel walls) by M. Chagnaud on the *Collecteur de Clichy*, Paris.

December, 1896, to April, 1897. Roof-shield running on side walls of the tunnel Section 6 of the Boston subway.

1899. Roof-shields running on side walls, used on the extension of the Orleans Railroad into Paris. Roof-shields running on track of wood and steel used on the Metropolitan tunnels.

The suggestion of using imbedded metal rods in masonry walls for jacks to push against was made by Walton I. Aims of New York in conversation with the writer in 1892, about four years before it was first made use of on Section 6 of the Boston Subway.

The proposed new route for the East Boston tunnel is shown on plate 1. Some of the reasons for adopting it in preference to the Hanover-street route are given in the Commission's report. Following is a brief comparison of some of the engineering features of the two routes:

Length of Routes.— The distance from Maverick square to Scollay square is substantially the same by both routes. The portion of the new route which lies under the harbor is about 20 per cent. longer than the corresponding portion of the old route.

Grades. — The new route will be somewhat more favorable on the Boston side.

Alignment. — That of the new route is decidedly preferable.

Material to be Excavated. — Borings indicate that the new route is through as favorable ground as the old.

Injury to Buildings. — The liability is less on the new route for about three-fourths of the distance from Maverick square to Scollay square. For the rest of the way there are tall buildings to be passed which will require careful consideration and treatment.

Valuable suggestions in regard to the work have been made by Assistant Engineers Edmund S. Davis, John E. Palmer, George H. Stearns, William W. Lewis, and others. The detailed reports given on the following pages are in the main condensations from those of my assistants.

WORK DONE ON SECTION A OF THE EAST BOSTON TUNNEL (MAIN CONSTRUCTION CONTRACT) DURING THE YEAR ENDING AUGUST 15, 1901.

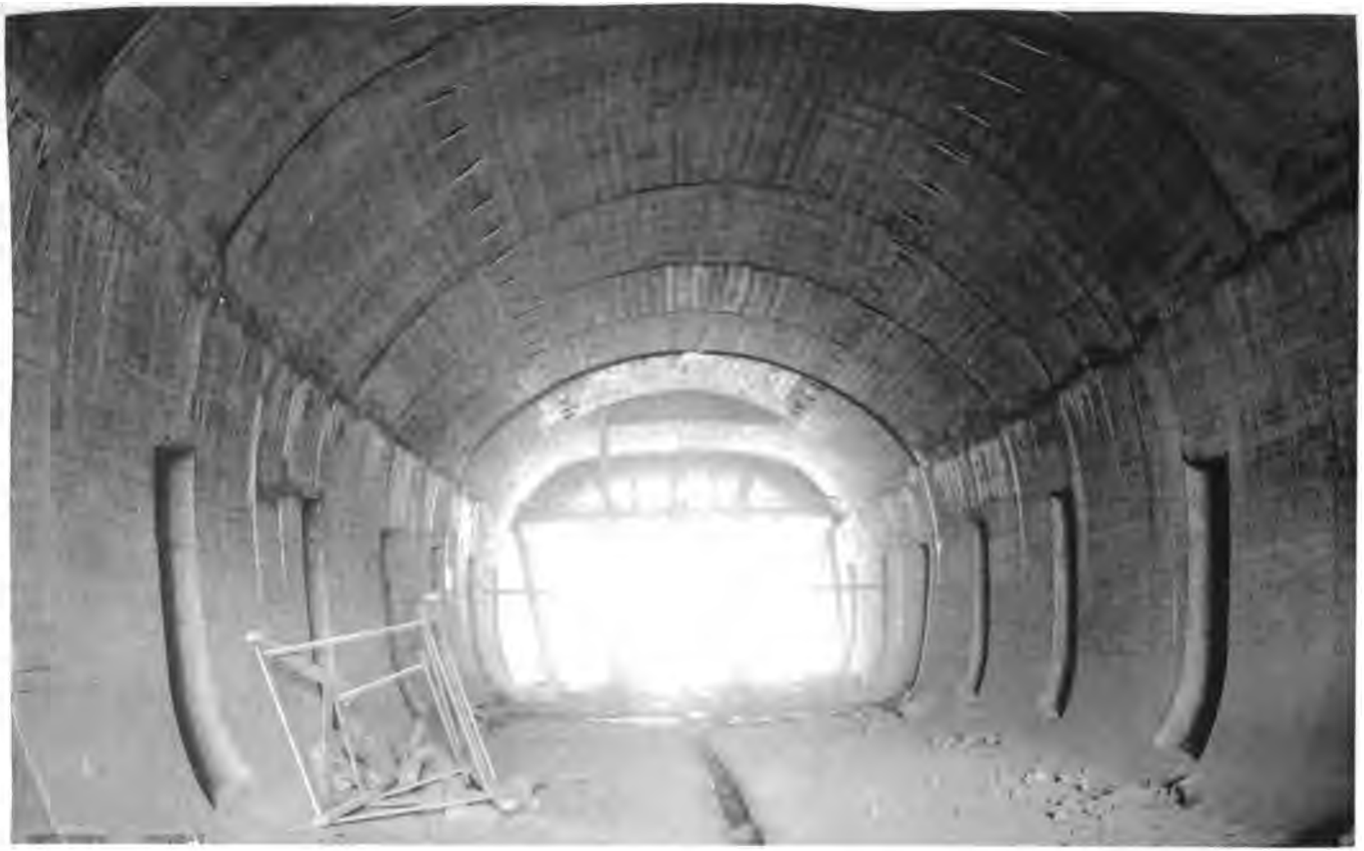
Location. — In Maverick square and Lewis street, East Boston — beginning in the square nearly opposite Winthrop street and ending in Lewis street 100 feet southwest of Webster street.

General Description of Structure. — The structure is for two electric railway tracks. It consists of 139 feet of open incline, constructed of concrete faced with granite and surmounted by granite coping, and a covered portion of 680 feet of concrete monolithic wide-arch subway. Expanded metal, twisted rods, or studded rods are imbedded in concrete two inches above centre at crown of arch in nearly all that portion of tunnel between Sumner and Webster streets. A 2-inch space is reserved around the interior of the tunnel for applying some treatment to the wall which will give it a more finished appearance.

Contractor for Construction. — National Contracting Company of New York; Wm. Mayo Venable, Local Manager; Wm. J. Lang, Superintendent.

Transit Commission Engineers. — John E. Palmer, Resident Engineer; William O. Wellington, L. Lee Street, transitmen; Samuel Rosnosky, John H. Graham, Robert A. Vesper, John H. Driscoll, rodmen, Frank

PLATE 2.



HELIOTYPE CO., BOSTON.

SECTION A OF THE EAST BOSTON TUNNEL, INTERIOR VIEW UNDER MAVERICK SQUARE
(LOOKING SOUTHWESTERLY). OCT. 25, 1900.

J. Eager, Charles C. Johnson, Chester N. Chubb, and Henry P. Reddington assisted Mr. Palmer in inspecting concrete and in other details of construction.

Date of contract.	Date of beginning work.	Date of final certificate.
April 24, 1900.	May 5, 1900.	Nov. 21, 1900.

Work Referred to in Previous Annual Report. — At the close of the period treated by the preceding report about 66 per cent. of the excavation and about 37 per cent. of the concrete (with proportionate quantities of water-proofing, and plastering) had been completed, together with substantially all of the stone masonry and coping of the incline.

Method of Doing Work. — All excavating was done by open cut. Construction methods were described in considerable detail in the preceding annual report.

Progress.

Items.	Amount of work done during year ending Aug. 15, 1900.	Date of completing.	Amount of work during year ending Aug. 15, 1901.	Average rate of progress per week during respective working periods, year ending Aug. 15, 1901.	Total quantities in completed section.
	Cubic yards.	1900.	Cubic yards.	Cubic yards.	Cubic yards.
Excavation . . .	13,290	Oct. 12.	6,796	850	20,086
Concrete	2,180	Nov. 11.	3,650	281	5,830
Stone masonry . .	55	Shortly after Aug. 15, 1900.	2	. . . .	57
Coping	21	Shortly after Aug. 15, 1900.	9	. . . .	30
Tarred felt . . .	2,980 sq. yds.	Oct. 12.	5,182 sq. yds.	648 sq. yds.	8,162 sq. yds.
Waterproofing . .	207 sq. yds.	Shortly after Aug. 15, 1900.	10 sq. yds.	. . . .	217 sq. yds.
Plastering	2,070 sq. yds.	Nov. 10.	2,837 sq. yds.	236 sq. yds.	4,907 sq. yds.
Setting steel and iron	. . . .	Nov. 11.	21 tons.	1.8 tons.	21 tons.

The daily force ordinarily employed was about 110 men and 10 teams. Work was carried on in one daily shift.

Character of Excavation. — The material excavated consisted in part of a stratum of filled ground increasing uniformly from a thickness of 2 feet in Maverick square to 12 feet at the southwesterly end of the section. This was filled in by the East Boston Company during the year 1833, from material taken largely from a hill located near where the Maverick House now stands. Piles and timber, the remains of an old dock, were taken out from 6 to 12 feet below the surface 20 feet southwest of Sumner street on Lewis street. This wood was badly decayed, there being only occasional single sticks which were fairly well preserved. Beneath the stratum of filled-in material was found yellow boulder clay northeast of Webster street; southwest of Webster street, immediately beneath the filled-in material, was found about 13 feet of silt, then blue clay to the required depth.

WORK DONE ON SECTION A OF THE EAST BOSTON TUNNEL IN ADDITION TO THAT COVERED BY THE MAIN CONSTRUCTION CONTRACT, DURING THE YEAR ENDING AUGUST 15, 1901.

The 12-inch water-pipe between Sumner street and a point about 50 feet beyond the southwesterly end of the section, on the southerly side of Lewis street, was moved about 10 feet from the line of the tunnel. The Transit Commission did the excavating and backfilling, and the Water Department furnished and laid the pipe. A 12-inch pipe was laid over the tunnel at Sumner street in a special crossing provided for it. This pipe was covered with a patent insulation to prevent it from freezing, the distance from the surface to the top of the pipe being only 2 feet.

Contracts will shortly be awarded for furnishing and erecting an iron fence on the coping and over the portal of the incline and for two granite posts with bases, on concrete foundation, at the head of the incline.

Park in Maverick Square. — Messrs. Gow & Foss, between September 10 and November 15, 1900, by contract:

Furnished and set in place in Maverick square about 344 linear feet (172 feet on northwest side of tunnel and 172 feet on southeast side of tunnel) of curbstone.

Set in place on curved lines about 410 linear feet of old curbstone — taking up and re-setting that which was then in the ground.

Relaid the paving disturbed outside the lines of the curbing.

Loam was furnished and placed in the park during the fall of 1900 and the area was graded and seeded in the spring of 1901. Both of these pieces of work were done by contract.

SECTION B OF THE EAST BOSTON TUNNEL (CONTRACT WORK).

Location. — Beginning at a point in Lewis street about 100 feet southwest of Webster street, East Boston, it runs beneath Lewis street to the South Ferry slip and is now being extended under the harbor on the line of Lewis street. As planned it will pass under Long wharf, Atlantic avenue, and State street. The Commission may, if it see fit, terminate the contract at a point in State street about 30 feet west of Atlantic avenue, in accordance with the provisions of a supplementary contract made July 17, 1901. The total length of the section to this point is about 4,350 feet. About 2,700 feet of this section is under the harbor; of the remainder, 680 feet is under Lewis street, East Boston, and 970 feet under Long wharf, Atlantic avenue, and State street. The straight portion is 2,712 feet in length. The depth required at the Harbor Commissioners' line and the requirement of the law that the entrance to the tunnel shall be in Maverick square necessitated a grade of about five per cent. The portion under the harbor will be nearly level, sloping somewhat towards the pump-well on the East Boston side of the channel. The slope on the Boston side of the harbor cannot be fixed precisely until a position is determined for a future subway in Washington street or vicinity. The thickness of the roof of earth over the outside of the arch of the tunnel under the harbor will be 18 feet and over, above which in the deepest part of the harbor will be about 35 feet of water at mean low tide.

General Description of Structure. — This section is an arched monolithic concrete structure for two electric railway tracks. The structure is 20.5 feet high and 23.3 feet wide inside. As in Section A, a 2-inch space has been reserved around the interior of the tunnel for applying some treatment to the wall which will give it a more finished appearance. The arch and walls are 33 inches and the invert 24 inches thick. Pump-wells and chambers under the harbor and ventilating chambers on each side of the harbor are included in this section. Refuge niches are built 20 feet apart in the side-walls of the tunnel.

Contractors for Construction. — The Boston Tunnel Construction Company (by assignment from Shailer & Schniglau Co. and Dunfee & Taylor) — Robert A. Shailer, President; Charles F. Taylor, Treasurer. Principal foremen, Michael Tallent and William McLaughlin.

Transit Commission Engineers. — John E. Palmer, Resident Engineer; William O. Wellington, Leonard Lee Street, transitmen; Charles C. Johnson and Frank J. Eager, assistants engaged in inspecting and in miscellaneous field and office work. The following assistants have been connected with the work more or less, some for a short time and some for several months: H. S. R. McCurdy, transitman; Robert A. Vesper, Albert J. Holmes, Guy C. Peterson, John H. Driscoll, rodmen; Samuel Rosnosky, Louis Loring, Arthur B. Cleaveland, Perley E. Boomer, John O. Macurdy, Charles P. Loveland, Clifford R. Fancy, James T. Frame, George H. Stearns, Frederick W. Fletcher, Arthur F. Bennett, Henry P. Reddington, Charles P. Horton, James B. Hayes, assistants on concrete masonry and details of construction.

There have usually been three inspectors on the work — one watching the mixing of the concrete, one watching the operations of making the concrete arch, and another watching the side-walls. While working in compressed air these inspectors have been relieved every eight hours, making nine inspectors in all employed during the twenty-four hours.

Date of contract.	Date of completion named in contract.
June 28, 1900.	June 15, 1903.

Data in regard to Plant.

Roof-shield built by James Russell Boiler Works Company, South Boston.

Weight of shield, without the hydraulic jacks and feed pumps, about 62 tons.

Diameter of shield, 28 feet 10 inches.

Length of shield, 12 feet 6 inches.

Hydraulic jacks (for pushing shield) made by Boomer & Boschert Press Co., Syracuse, N.Y.

Number of hydraulic jacks, 16, each with a capacity of 75 tons.

Air-locks built by James Russell Boiler Works Company, South Boston.

One high-pressure compressor with a capacity of 710 cubic feet of free air per minute. Usual pressure is 125 pounds per square inch. One compressor with a capacity of 1,040 cubic feet of free air per minute. Usual pressure is 18 pounds per square inch. One compressor with a capacity of 528 cubic feet of free air per minute. Usual pressure is 18 pounds per square inch.	Furnished by Ingersoll-Sergeant Drill Co., New York City.

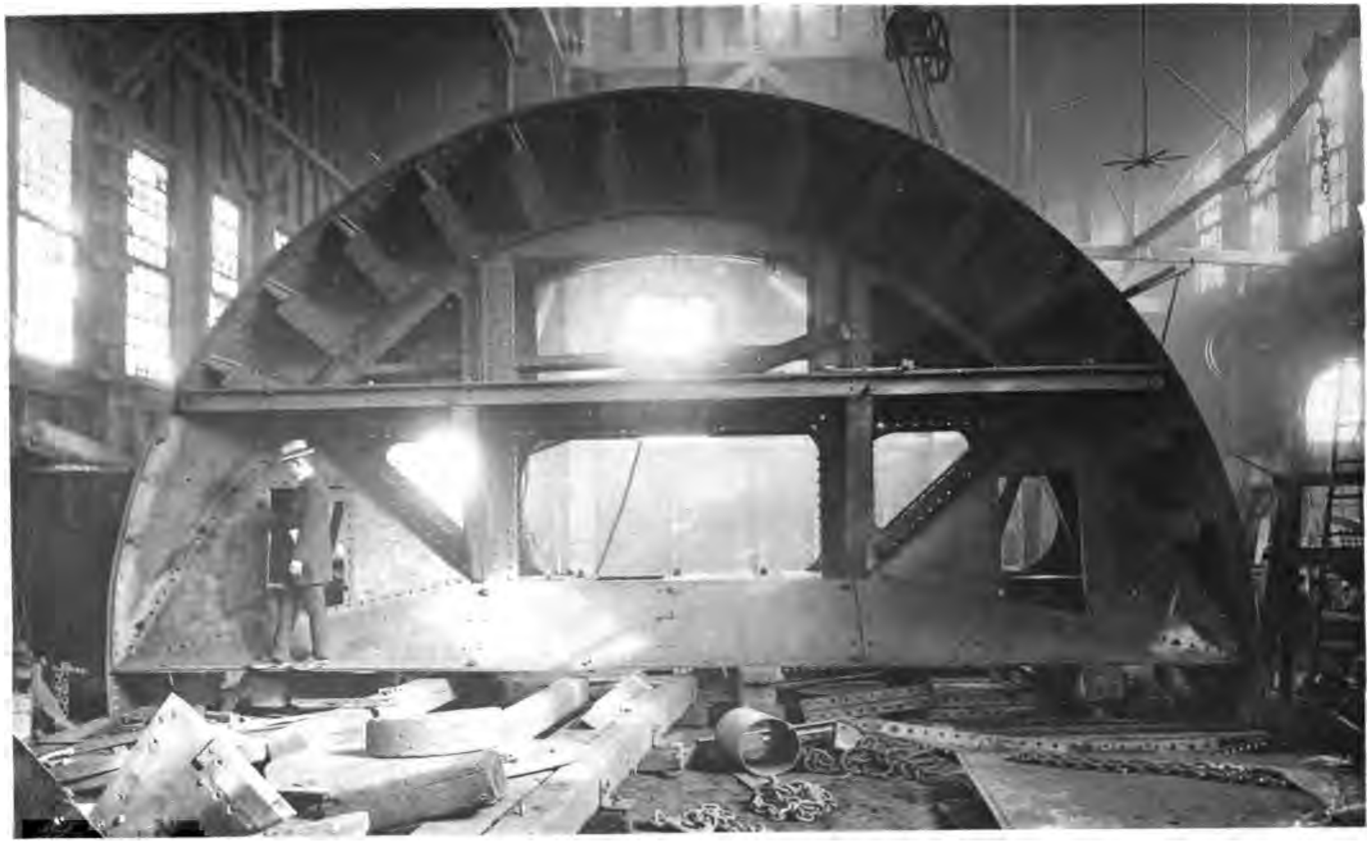
The high-pressure compressor furnishes power for the machinery. One of the remaining two furnishes compressed air in which to work and one is held idle as a reserve.

There are also in use on the work : 3 100 horse-power boilers, 3 air receivers, 1 Carlin cubical concrete mixer, 3 hoisting engines, 1 small engine to run mixer, 1 elevator, 40 small cars, 2 small steam pumps.

Details of Construction. — One difficulty anticipated in constructing the concrete tunnel with the use of a roof-shield was that of keying up the arch, by reason of the very small space in which the operation must be performed, and on account of the instability of fresh concrete. At the time the specifications were prepared it was thought it might be expedient in the extreme upper part to make use of bags made of gauze (metal or vegetable) filled with concrete. While the earliest construction operations were in progress experiments were made by the Engineer's Department with various methods of keying up in which the conditions occurring as to confined space, shape, etc., were precisely represented by wooden frames and molds. A satisfactory method was found which has since been followed, and is described later.

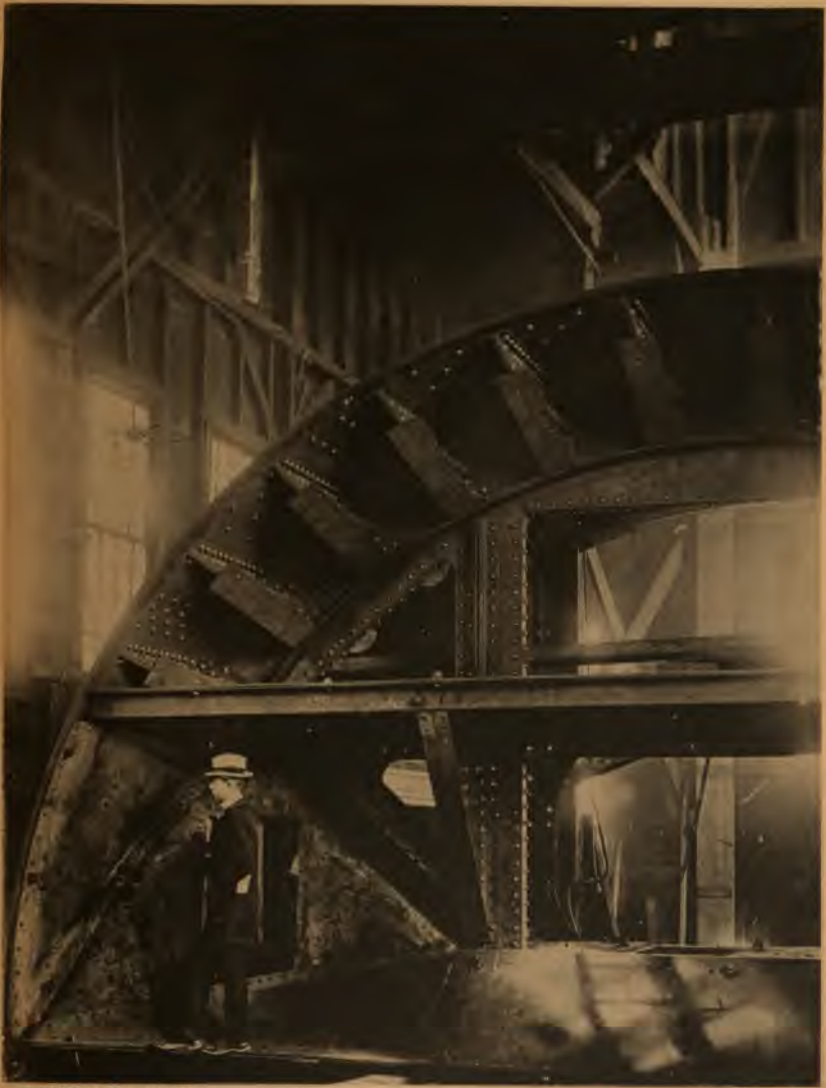
A shaft (34 feet by 36 feet) was excavated at the East Boston end of Section B to the required depth of 42 feet. The concrete invert was then put in, after which the side-walls were built up to within 16 inches of the springing line of the arch. The side-walls were terminated at this height in order to serve as foundations for tracks upon which the roof shield could run. As soon as the shaft was excavated to the required depth, side-drifts 8 feet square were begun in which to build the walls of the tunnel in advance of the shield. The timbering of the drifts consisted of 8-inch square spruce caps and 8-inch square spruce legs on the tunnel side of drifts, placed solidly together, while on the outside 8-inch square spruce legs were set 2.5 feet apart on centres, with a longitudinal 6-inch by 8-inch

PLATE 3.



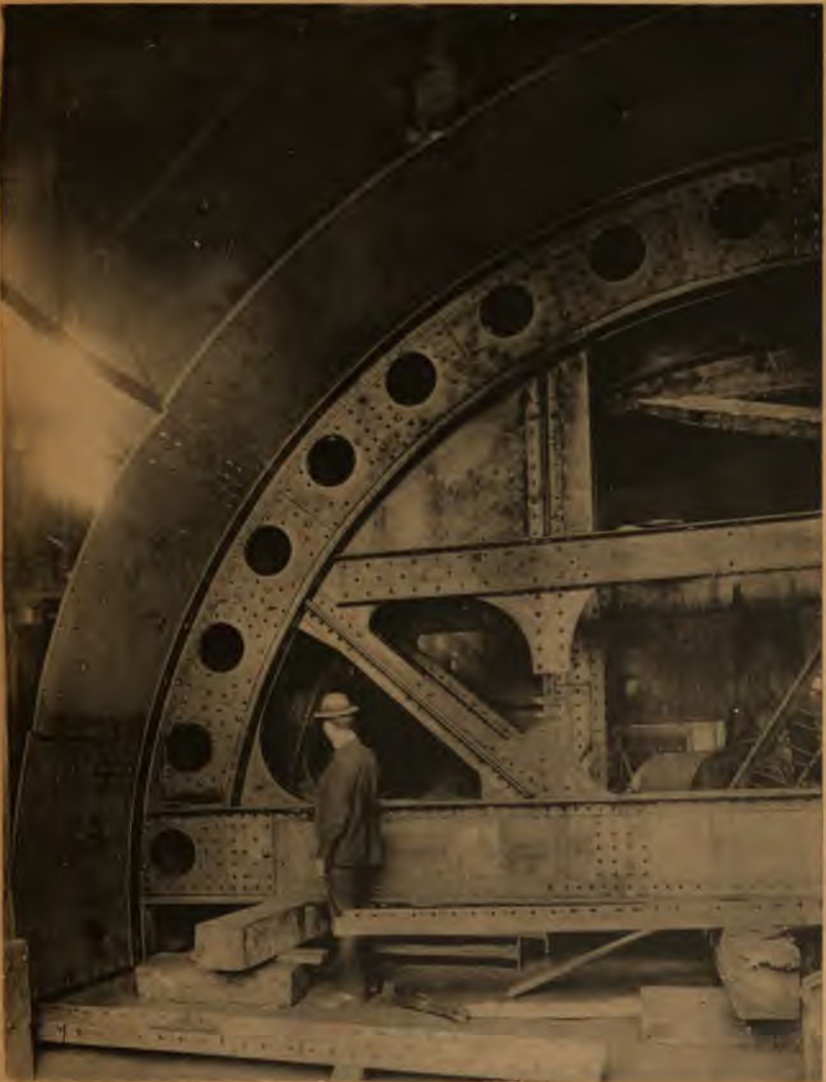
HELIOTYPE CO., BOSTON.

SECTION B OF THE EAST BOSTON TUNNEL, FRONT OF UNCOMPLETED ROOF-SHIELD. NOV. 22, 1900.



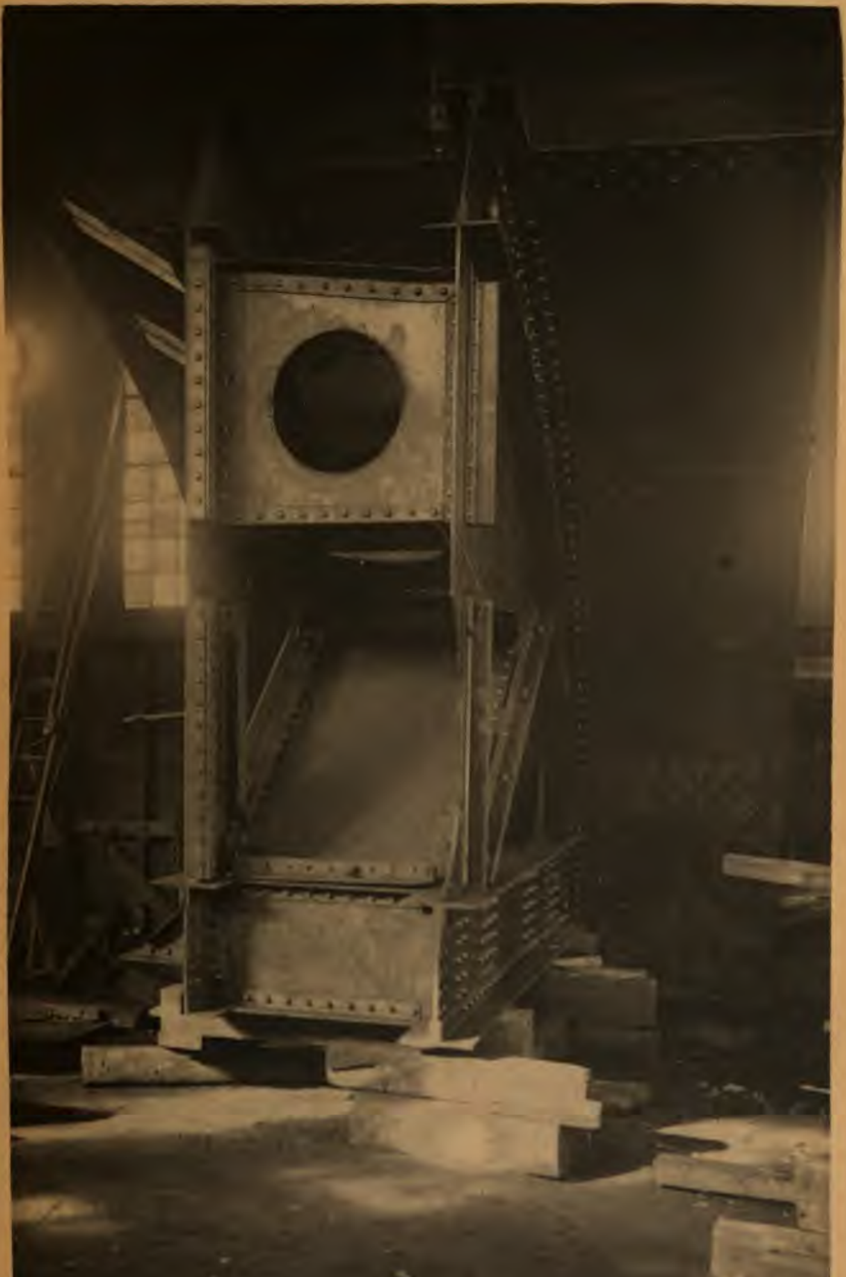
HELIOTYPE CO., BOSTON.

SECTION B OF THE EAST BOSTON TUNNEL, HALF OF FRONT OF UNCOMPLETED ROOF-SHIELD. NOV. 26, 1900.



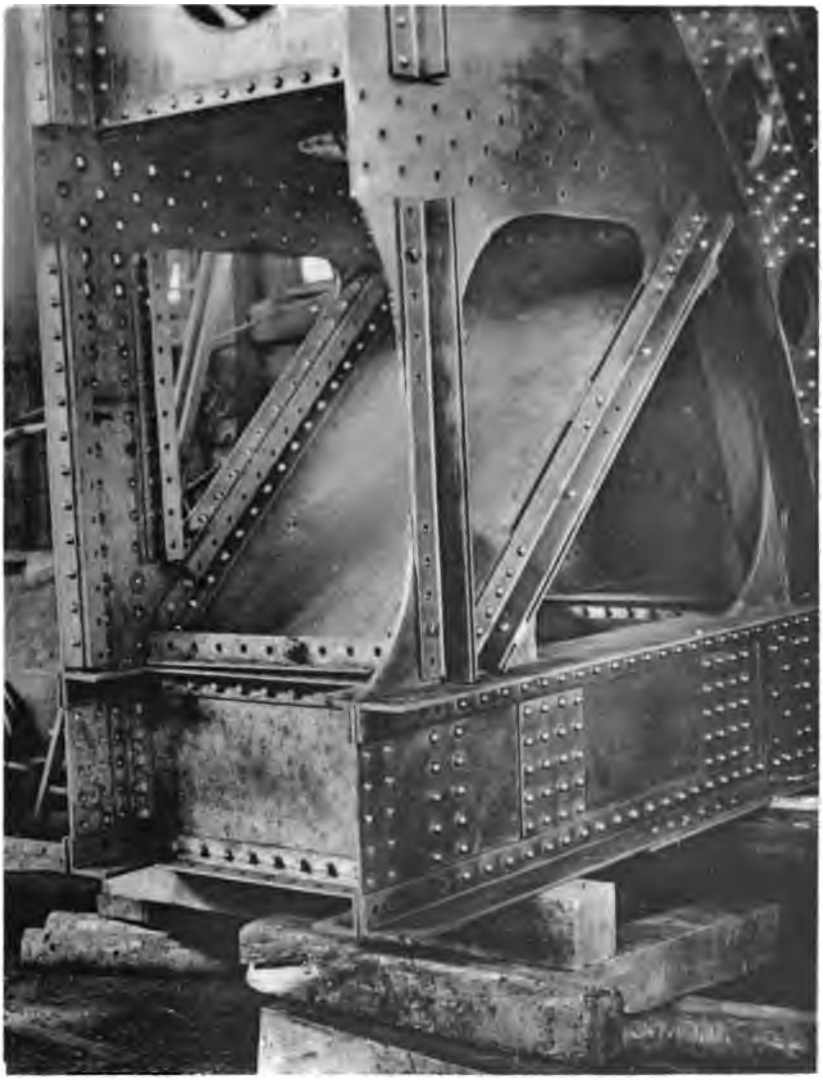
HELIOTYPE CO., BOSTON.

SECTION B OF THE EAST BOSTON TUNNEL, HALF OF REAR OF UNCOMPLETED ROOF-SHIELD. OCT. 27, 1900.



HELIOTYPE CO., BOSTON.

SECTION B OF THE EAST BOSTON TUNNEL, LONGITUDINAL SECTION OF ROOF-SHIELD. NOV. 28, 1900.



HELIOTYPE CO., BOSTON.

SECTION B OF THE EAST BOSTON TUNNEL, DETAIL OF INTERIOR OF ROOF-SHIELD. NOV. 28, 1900.

timber at top and bottom and with 2-inch plank outside. This method has been continued up to the present time, Aug. 15, 1901. The excavated material in side-drifts was removed to the shaft in wheel-barrows and hoisted to the surface by a derrick and hoisting engine. This method was pursued for the first 200 feet, until the shield was in position at the bottom of the shaft and ready to be advanced. When the side-drifts had been driven to a distance of 40 or 50 feet, the bottom was excavated and the foundation for the walls was put in in lengths of from 16 to 20 feet. As soon as this concrete foundation was sufficiently set, a longitudinal 6-inch by 8-inch timber was placed in position beneath the caps overhead and securely supported by means of posts set on the concrete foundation, and 3 feet from the outer line of the tunnel. After these posts were securely in position, the outside posts were removed and the concrete wall was put in up to within 16 inches of the springing line of the arch. These operations followed each other as closely as the necessary working space permitted.

The shield (see plates 3 to 11) was brought to the ground mainly in two sections, and in such shape that they could be easily lowered into position and assembled on top of the finished side-walls in the shaft — which was timbered in such a manner as to facilitate this work. When the shield was assembled and riveted 16 hydraulic jacks were placed in the openings prepared for them and connected with pumps also placed in the shield. It rests on 16 live iron rollers (8 on each side) which in turn rest on steel plates placed on top of the side-walls. These plates are flanged to act as a guide to the shield when moving. The rollers are 8 inches in diameter and 16 inches long. The shield was moved up to the bulkhead, the latter was removed and the shield forced into the bank — the jacks thrusting against 12-inch square timbers arranged so that the pressure was transmitted directly to the arch of the completed Section A. The shield was forced into the bank to its full length, the interior earth being removed as the shield advanced, and the first arch (2½ feet long) was turned. Sixteen lines of iron push rods, each 3¼ inches in diameter, and about 30 inches long, are imbedded in the concrete arch in proper position to receive the thrust of the jacks. Curved steel ribs made of 10-inch channels 30 inches apart are used as centering for each ring of arch. Lagging (4 inches thick) cut to radial lines is placed on the ribs as the concrete is put in. Wooden bulkheads attached to the plungers of the hydraulic jacks help to confine the fresh concrete. A cross beam on the steel rib serves as a support for the platform from which the concrete is put into the arch. The final keying up of each ring of the arch is done through two holes (about 13 inches in diameter, originally intended to receive hydraulic jacks) in the rear girder at the top of the shield. Curved sheet-iron troughs are extended from these holes to the top of the arch. Concrete thrown into the troughs is pushed by properly shaped hand rammers into the remaining unfilled space at the crown of the arch. As soon as one ring of arch is completed the shield is forced forward 30 inches and another ring of arch is put in. The space left vacant over the completed arch ring by the advancing tail-piece of the shield is filled with grout, composed of two or more parts fine sand and one part cement, which is forced through a vertical pipe placed at the crown of each arch ring. Each centre is kept in place for 30 days and is then struck and carried forward to be used again.

The excavation of the core is done at the same time the arch is being built. The invert is excavated and concreted in 10-foot sections at a distance of about 20 to 30 feet back of the shield. The side-drifts and walls are kept uniformly about 100 feet in advance of the shield. These methods of operation have been maintained with but little change from the beginning. Inaccuracy in placing the rollers under the shield has sometimes resulted in getting the shield out of line, — 4 inches in one case, — but this has not changed the interior axis of the tunnel. The various phases of construction are shown on plate 8.

Small cars, each with a capacity of about one cubic yard, are used for transporting material between the shaft and the headings. There are three main lines of track for these cars, inside the tunnel southwest of the air-locks. Two of these tracks are on the sides of the lower part of the tunnel, and are used for cars loaded with excavated earth or with concrete. The third track is in the centre and near the top of the tunnel, and is for taking in cars of concrete used in constructing the upper part of the arch. The earth is loaded on the cars at the heading, taken through the locks to the shaft, lifted by the cage to an elevated railroad, run over the low wooden building on the south side of Lewis street, and there emptied by dumping into ordinary gravel cars, which are hauled away by the Boston & Maine Railroad. The cars are moved as follows: From the heading up an incline to a point about 50 feet from the air-locks, by a cable worked by a winding engine employing compressed air; on a level to and through the air-locks, by momentum and with the men guiding; to the cage in the shaft, on a level and with men pushing; raised in the cage by steam power; on a level along the elevated railway, by

man power. The arrangement of the contractors' plant is shown on plate 11.

The specifications provide, regarding the dry ingredients of the concrete, that "To each 123 pounds of dry Portland cement there shall be 2½ cubic feet of sand and 4 cubic feet of gravel." Crushed stone has been used in place of gravel, and fine crushed stone has been used in place of sand, and for the portion put in prior to the use of compressed air the concrete was made richer in cement than is above stated. The mixing plant is so arranged that the cement is passed to the mixer from the storage shed through a galvanized iron tube, and the stone dust and broken stone from bins directly over the mixer, all with a view of reducing the handling of materials to a minimum. The concrete, when mixed, is dumped directly from the mixer into small cars, in which it is carried through the locks to the headings.

Some experiments in regard to cement and concrete are given in the Appendix.

When the shield had been advanced about 230 feet, work was suspended for about two weeks to put in the three air locks. Each of these is 27 feet and 3 inches long, has an internal diameter of 6 feet, is made of boiler-iron, and has at each end a tight-fitting door 49 inches high and 39 inches wide. The locks are placed about 110 feet from the shaft, the two on the sides being about 6 feet above the invert, and the middle one about 13.5 feet. The two lower locks are used for working purposes, and the upper middle lock for emergency only. A dome-shaped bulkhead of brick masonry, convex on the side of the compressed air, 3 feet thick, with angle iron hoops, was built around the inner end of the locks, making the tunnel beyond this point a tight compartment in which compressed air could be held without undue leakage.

For the benefit of non-professional readers it may be stated that an air-lock is a sort of vestibule through which men and materials must pass in going from the free air to the compressed air or in returning. One of its two doors must always be closed to prevent the escape of the compressed air. During the operation of going in both doors are for a time tightly closed and by means of valves the air within the chamber is gradually brought to the pressure of the compressed air, when the inner door may be opened. In going out a similar but reverse process is used. The time usually taken by the men in passing through a lock is about one minute. Compressed air was at first used — May 5 — with a pressure of only 5 pounds per square inch above the atmosphere. This pressure was increased somewhat each day until 18 pounds was reached. Greater pressure will doubtless be required later. As was expected, the use of compressed air lessened the settlement of buildings and of the street. It also lessened very appreciably the stresses on the drift timbers, caused by the surrounding earth. As soon as compressed air was used the temperature inside advanced to 82° F., at about which point it has since remained. One feature tending to increase the warmth inside the tunnel is the heat produced by chemical action in the concrete — the rise of temperature in the middle of a wall two days after the concrete sets being 40 * degrees above that of the air in the tunnel. About 12 days after setting, the temperature has receded to that of the air. The humidity is very high. The greatest amount of carbonic acid gas found at any time in the tunnel has been 69 parts in 10,000. Most of the time it has been found to be from 10 to 16 parts in 10,000. The compressed air is delivered behind the shield, in the top of the shield, and in both drifts. Air escaping through the ground to the surface of the street is very noticeable in rainy weather, making itself evident by bubbles on the pavement. The sound of passing ferry boats and of a pile driver working near by has been plainly heard by men in the drifts.

Character of Material Excavated. — The greater part of the excavated material up to the present time (Aug. 15, 1901) has been blue clay, weighing about 120 pounds per cubic foot. For a length of 300 feet from the shaft silt and coarse black sand were found near the crown of the arch in a stratum varying in thickness from 1 to 10 feet. Very little water was encountered, and that only near the shaft in the sand and silt stratum just mentioned. This water was drained into a sump in the shaft and pumped out with a small Worthington pump.

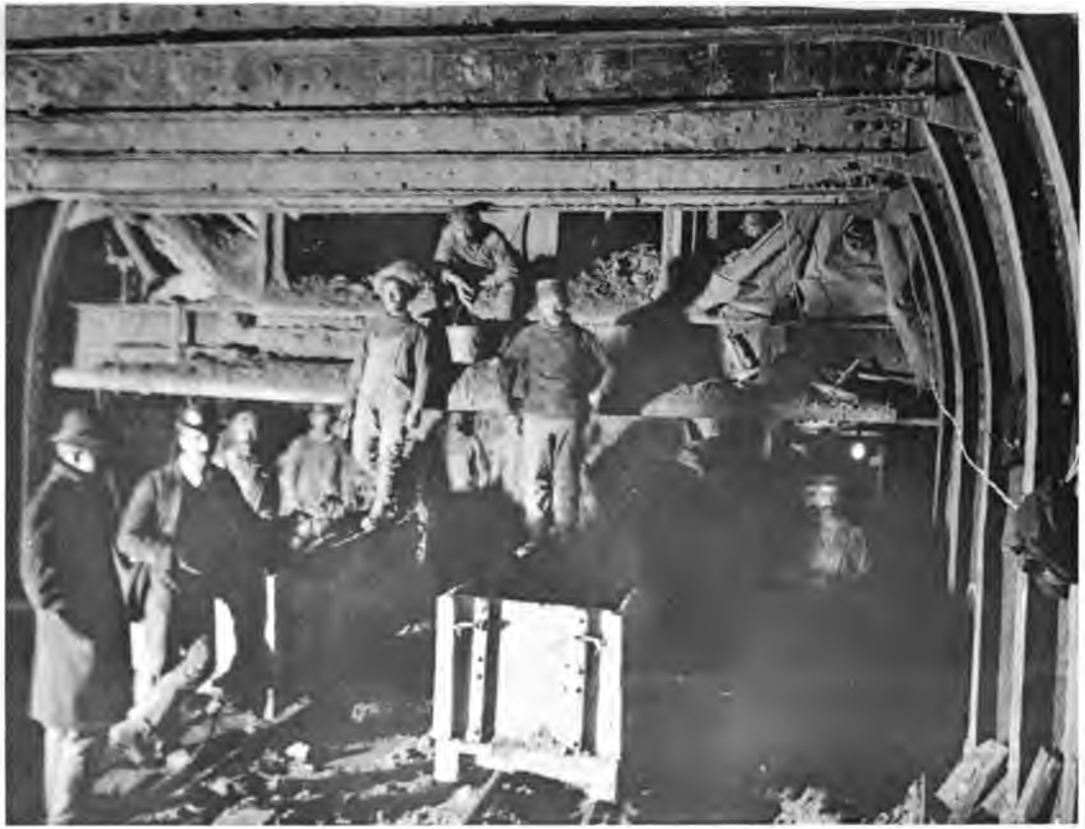
Progress.

ITEMS.	Date of beginning, 1900.	Amount of work done during the year ending Aug. 15, 1901.	Progress for week ending Aug. 15, 1901.	Estimated total quantities.
		Cubic yards.	Cubic yards.	Cubic yards.
Excavation.........	Aug. 13	15,824	700	102,000
Concrete	Sept. 19	5,017	234	39,000

---

* The result of one experiment.

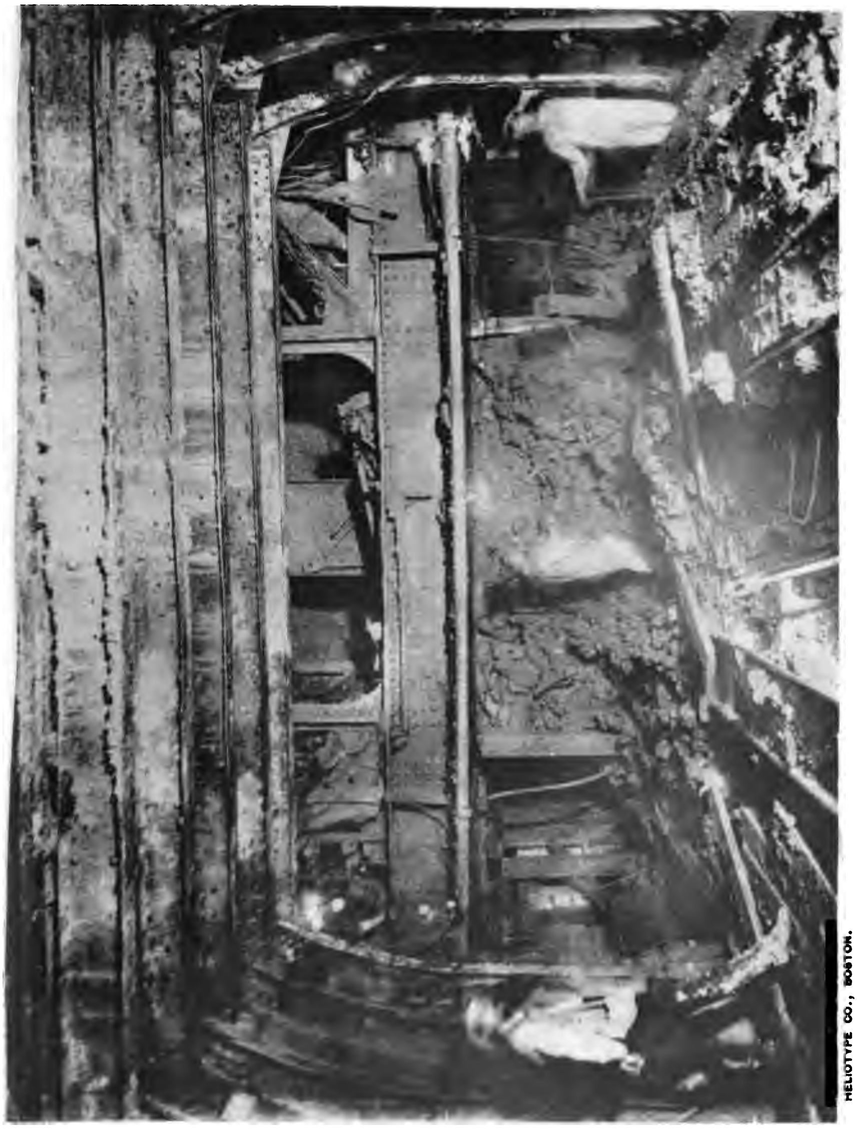
PLATE 9.



HELIOTYPE CO., BOSTON.

SECTION B OF THE EAST BOSTON TUNNEL, BOTTOM OF MAIN HEADING, REAR OF ROOF-SHIELD, STEEL CENTERING AND CROSS-BEAMS, EARTH CARS. MARCH 16, 1901.

PLATE 10.



HELIOTYPE CO., BOSTON.

SECTION B OF THE EAST BOSTON TUNNEL, STEEL CENTERING AND CROSS-BEAMS, REAR OF LOWER PART OF ROOF-SHIELD, MAIN HEADING AND SIDE-WALL DRIFTS.

At the present time (Aug. 15, 1901) 636 feet of the masonry structure is practically completed, each side-wall is constructed for about 105 feet in advance, and the headings of the side-drifts are some 46 feet still further beyond.

Some data in regard to progress with the shield are:

Some parts lowered into shaft	Nov. 30, 1900.
All on the ground	Dec. 1, 1900.
Substantially erected	Jan. 1, 1901.
First move in advance	Jan. 5, 1901.
First arch turned	Jan. 26, 1901.

The progress since January 26 is shown by the following table:

Monday mornings, 1901.	Station of forward end of rib.	Progress during week, feet.
Jan. 28	8 + 57.92	2.50
Feb. 4	8 + 67.92	10.00
" 11	8 + 85.42	17.50
" 18	9 + 05.42	20.00
" 25	9 + 25.42	20.00
March 4	9 + 37.92	12.50
" 11	9 + 60.92	23.00
" 18	9 + 88.42	27.50
" 25	10 + 18.42	30.00
April 1	10 + 37.50	19.08
" 8	10 + 65.00	27.50
" 15	10 + 82.50	17.50
" 22	10 + 85.00	2.50
" 29	10 + 85.00	0.00
May 6	10 + 95.00	10.00
" 13	11 + 15.00	20.00
" 20	11 + 37.50	22.50
" 27	11 + 57.50	20.00
June 3	11 + 77.50	20.00
Carried forward		322.08

Monday mornings, 1901.	Station of forward end of rib.	Progress during week, feet.
Brought forward		322.08
June 10	12 + 00.00	22.50
" 17	12 + 22.50	22.50
" 24	12 + 40.00	17.50
July 1	12 + 67.50	27.50
" 8	12 + 92.50	25.00
" 15	13 + 22.50	30.00
" 22	13 + 52.50	30.00
" 29	13 + 82.50	30.00
Aug. 5	14 + 12.50	30.00
" 12	14 + 40.00	27.50
Total		584.58

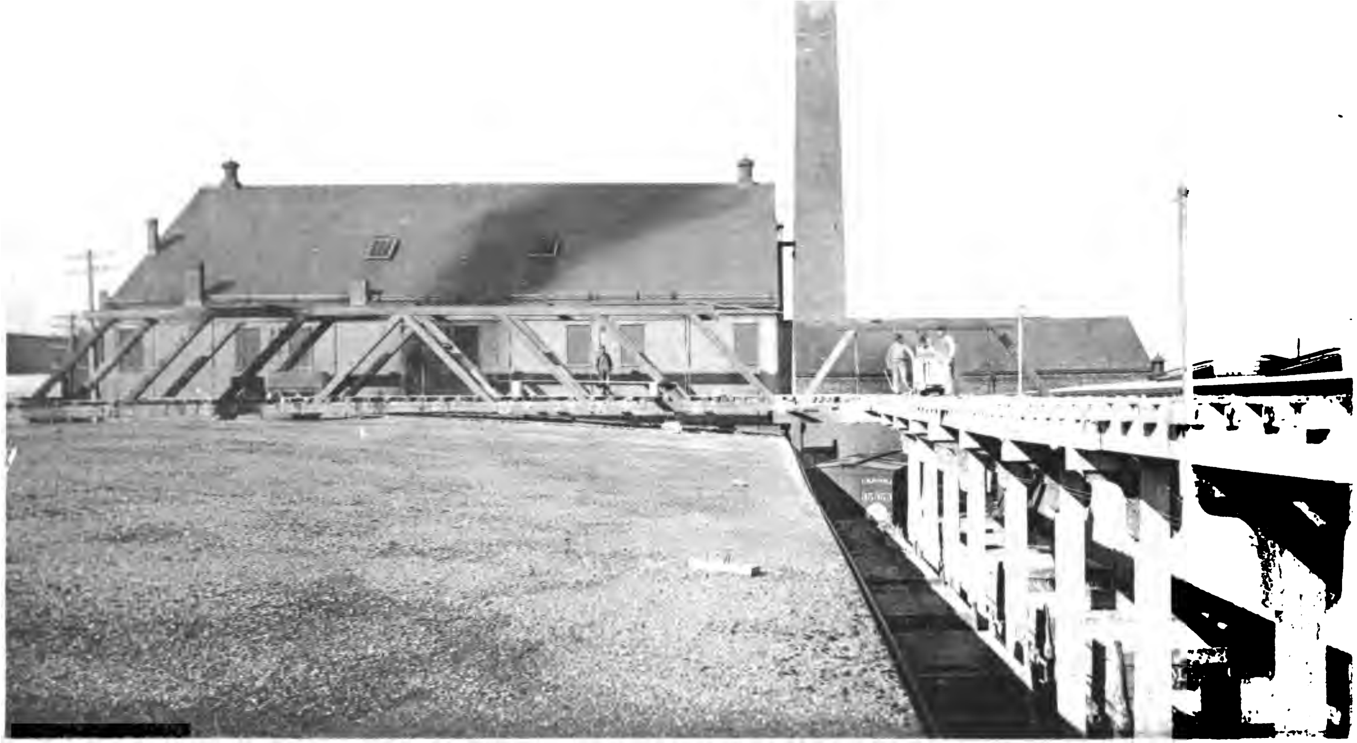
There are about 22 cubic yards of excavation per running foot of tunnel and about 8 cubic yards of concrete.

The total force of men ordinarily employed is approximately 140. These are about equally divided between day and night shifts of 11 hours each, working 6 days per week.

Lines and Grades. — The alignment of the tunnel is maintained by producing lines into each side-drift, each line being 9 feet from the centre of the tunnel. From these two lines the walls are put in, the position of arch and invert being fixed by the walls. Grades are also given for the walls and for the steel ribs which support each 30-inch ring of arch. The lines were transferred from the surface of the street through Section A and down through the shaft at the beginning of Section B. No difficulty has been experienced in transferring lines through the air locks. Lines on each side of the harbor were connected together by means of triangulation.

Death of Samuel Rosnosky. — At 3 P.M., Dec. 5, 1900, while assisting in triangulating across the harbor, Samuel Rosnosky, rodman, in the employ of the Transit Commission, had both hips crushed by a large metal cylinder rolling upon him from a small hand truck which he with others was

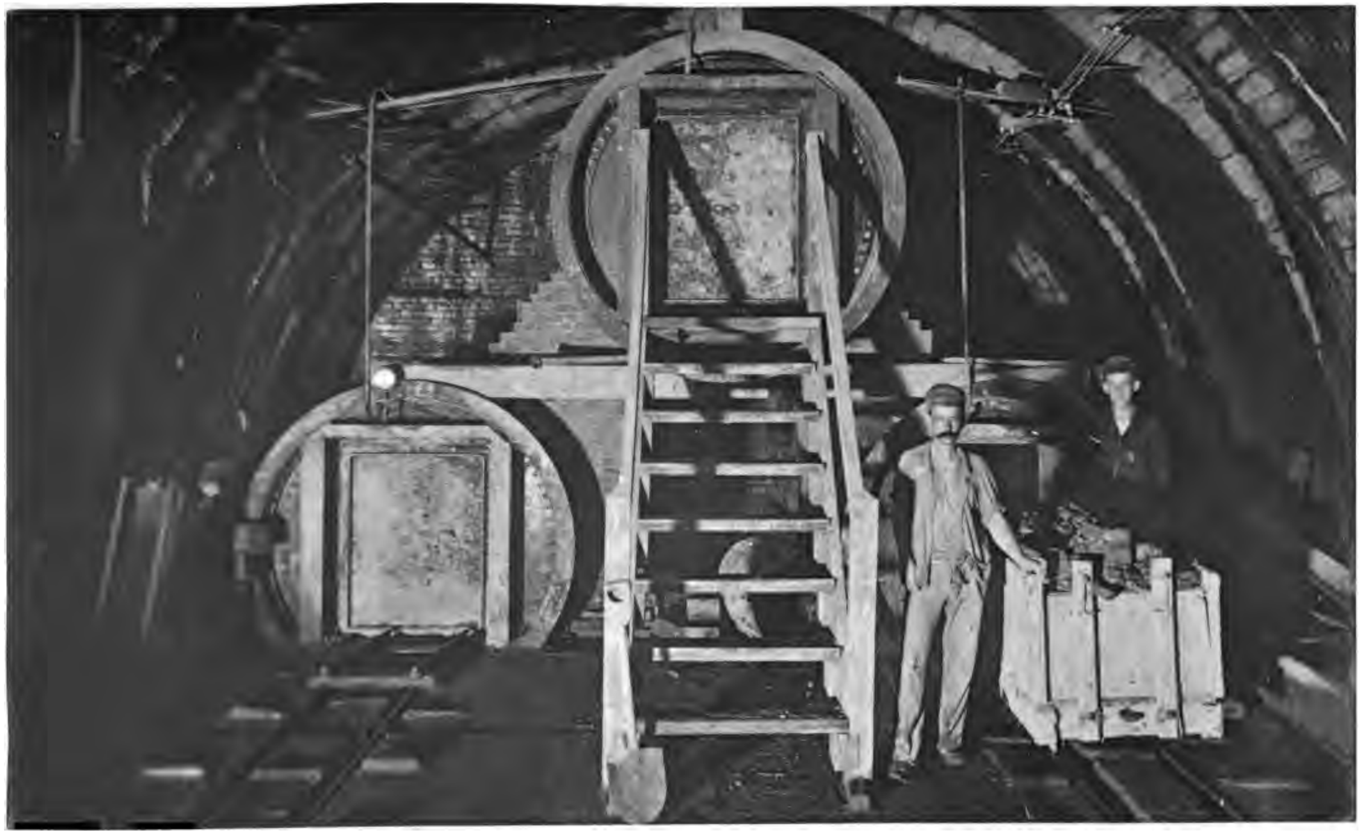
PLATE 12.



HELIOTYPE CO., BOSTON.

SECTION B OF THE EAST BOSTON TUNNEL, RAILWAY FROM SHAFT IN LEWIS STREET TO CARS OF BOSTON & MAINE RAILROAD -- FOR DISPOSING OF SURPLUS EARTH. MARCH 16, 1901.

PLATE 13.



HELIOTYPE CO., BOSTON.

SECTION B OF THE EAST BOSTON TUNNEL, OUTSIDE (FREE-AIR-SIDE) OF AIR-LOCKS. (LOOKING SOUTHWESTERLY).

in the act of moving out of line, on Lockwood's wharf. He died at about 6 o'clock that evening. Mr. Rosnosky was a young man of more than average ability, who performed his duties faithfully and well, and whose character was so attractive that his death was deeply regretted by all who had associated with him. This is the only fatal accident which has occurred to any member of the engineering staff of the Commission during its seven years of service.

BORINGS IN CONNECTION WITH THE CHANGE OF ROUTE FOR SECTION B.

Nineteen land borings and 59 harbor borings, varying in depth from 34 feet to 80 feet, have been made for this work during the year ending Aug. 15, 1901, by Edward A. Clark of 170 Summer street, Boston, under a contract with the Transit Commission.

WORK DONE ON CHANGES IN SUBWAY NEAR PLEASANT STREET DURING THE YEAR ENDING AUG. 15, 1901.

Location. — In and adjacent to the nearly triangular space included between Shawmut avenue and Tremont street, and between Warrenton street and Pleasant street.

Contractor for Steel-work.—G. W. & F. Smith Iron Company, Roxbury.

Contractor for Construction. — Patrick McGovern, 57 Maywood street, Roxbury.

Transit Commission Engineers. — Edmund S. Davis (until his leg was broken, in an accident which occurred on the work October 15), Wm. W. Lewis (from October 16 to the completion of the work), Assistant Engineers; Harry S. R. McCurdy, transitman; Albert J. Holmes, rodman; Henry P. Reddington, day inspector; John J. Falvey, night inspector.

Contract for	Date of contract.	Work begun.	Date of certificate of completion.
Furnishing steel	Aug. 30, 1900.		
Construction	Sept. 5, 1900.	Sept. 10, 1900.	Dec. 19, 1900.

General Description of Structure. — As originally built the southern end of the subway was an open four-track inclined approach which permitted the street surface cars to descend and enter the subway and *vice versa.* The two westerly tracks connected with the surface tracks in Tremont street and the two easterly tracks with the surface tracks in Shawmut avenue.

The work in this locality was to make such changes in the subway as was required to enable trains from the elevated railway to go under Pleasant street and enter the subway. All the work on the subway terminated at the northerly side of Pleasant street. The inclined approach thereto, through private property easterly of Porter street and south of and under Pleasant street, was constructed by the Elevated Railway Company. The change in the subway consisted in lowering the grade of the extreme easterly and extreme westerly inverts so as to connect with the lower end of the inclined approach (leading from the elevated structure to the subway), built by the Boston Elevated Railway Company under Pleasant street, and building an island platform, for the use of the cars from the elevated road, between these two tracks. The use of the two inside tracks was discontinued when the elevated was put in operation. The change begins in the subway about 150 feet north from the portal.

The original subway walls are underpinned with concrete. The steel posts in the side-walls are spliced to the required length. A concrete retaining wall with granite face was built on each side from the subway portal connecting with the Boston Elevated Railway Company's work at Pleasant street. A 30-inch water-pipe in Tremont street which interfered with the side-wall for a short distance was relocated for about 50 feet.

Method of Operation. — The underpinning of the walls was done in small sections, each about six feet long, taken alternately. While the work on the westerly side was going on all the cars were run on the two easterly tracks. When the work on the westerly side was completed a temporary wooden trestle was built by the railway company and all the cars were run over it, thus giving an opportunity to finish the easterly side. Work was carried on day and night.

Two Sub-Passageways in the Scollay-square Station of the Subway, Connecting the Easterly Platform with the Central Platform.

Contractors.

Excavation, furnishing, and putting in place concrete masonry, removing old concrete masonry, furnishing and applying coating of Portland cement mortar, applying waterproofing, setting steel I-beams, laying 6-inch vitrified pipe, brick-work made with Portland cement mortar, etc., Metropolitan Contracting Company, 95 Milk street, Boston.

Setting about 254 square yards of backing composed of terra cotta half-ribbed tiles, M. J. FitzGerald, 20 Dickinson street, Somerville.

Furnishing and putting in place 3-inch × 6-inch Opalite tiles on walls and ceiling in the northerly sub-passageway and ⅜-inch × 3-inch × 6-inch enameled clay tiles in the southerly sub-passageway, William H. Smith, 2A Park street, Boston.

Furnishing and putting in place artificial stone for floors, stairs, and landings, furnishing and setting strips of Mason Safety Tread, furnishing and erecting iron fence around two openings on the easterly platform, etc., W. A. Murtfeldt Co., 192 Devonshire street, Boston.

Furnishing and putting in place wooden hand-rails, Isaac McLean, 31 and 33 Lancaster street, Boston.

Table of Progress.

	Date of contract.	Date of substantial completion.
Excavation, concrete masonry, etc.	April 25, 1901	May 19, 1901
Terra cotta half-ribbed tiles	May 15, 1901	May 23, 1901
Opalite tiles and enameled clay tiles	May 20, 1901	May 31, 1901
Artificial stonework for floors and stairs and iron fence	May 14, 1901	June 3, 1901
Wooden hand-rails	June 3, 1901	June 5, 1901

The above-mentioned sub-passageways were made at the request of the Boston Elevated Railway Company as a part of its scheme for adapting the Scollay-square station to the running of elevated trains. The walls of the passageways are constructed mainly of concrete and the roofs are strengthened by 6-inch steel I-beams. Each passage is 4 feet 6 inches wide inside and has an internal height of 7 feet 6 inches. The floor lengths in the northerly and southerly sub-passageways are respectively about 33 and 27 feet.

All operations on the surface of the platforms and stairways were conducted within spaces enclosed by smooth board fences. The cars ran at short intervals through the station between six o'clock in the morning and twelve o'clock at night, and experimental and other cars ran more or less during the intervening time. There was no interference with the running of cars except as allowed by the officers of the railway company. The contractors were permitted to bring in and take out material through the north Scollay-square exit and through one-half of the Brattle-street exit, and cars loaded by them with construction material or surplus earth or waste were hauled, when required, by trolley cars, between the Scollay-square station and the incline at Travers street.

Respectfully submitted,

H. A. CARSON,
Chief Engineer.

APPENDIX A.

EAST BOSTON TUNNEL.

CONCRETE BEAMS, VULCANITE CEMENT.

No. of Beam.	Date when Made.	Date when Broken.	Wt. of Beam.		Breaking Strength of Beam.	Modulus of Rupture.	Proportions.	Days in Ground.	REMARKS.
	1900.	1900.							
1	Oct. 2	Nov. 3	114	Beams 6″× 6″×30″.	2250	445	570 lbs. cement; 7.72 cu. ft. coarse, clean, and sharp sand; 12.36 cu. ft. good gravel.	28	Gravel coated with a fine film of dirt.
2	" 3	" 3	114		2235	442		27	" " " " " " " "
3	" 15	" 22	115		2865	573		30	Gravel washed.
4	" 16	" 22	116		3070	640		29	" "
5	" 26	" 28	114	Beams 6″× 6″×26″.	3570	624	570 lbs. cement. 7.72 cu. ft. coarse, clean, and sharp sand. 12.36 cu. ft. trap rock, 1″—2½″.	32	
6	" 30	" 30	116		3545	618		28	
7	" 31	Dec. 1	117.5		3080	530		27	
8	Nov. 1	" 1	114		3565	623		29	
9	" 2	" 1	112		3625	634		28	
10	" 3	" 4	111.5		3580	626		27	
11	" 5	" 5	113		2000	341		25	
12	" 6	" 6	115.5	Beams 6″× 6″×30″.	3660	738		24	
13	" 7	" 8	114		3980	805		31	
14	" 8	" 8	111		3300	664		30	
15	" 9	" 11	113		2655	529		29	
16	" 10	" 11	114		2620	522		28	

APPENDIX A. — *Continued.*

EAST BOSTON TUNNEL. — CONCRETE BEAMS, VULCANITE CEMENT.

No. of Beam.	Date when Made.	Date when Broken.	Wt. of Beam.	Breaking Strength of Beam.	Modulus of Rupture.	Proportions.	Days in Ground.	REMARKS.
17	Nov. 12	Mar. 29, 1901	107	3610	730	570 lbs. cement. 7.72 cu. ft. coarse, clean, and sharp sand. 12.36 cu. ft. trap rock, 1″ — 2½″.	137	Left in ground through the winter.
18	" 13	" " "	113.5	4925	1000		136	" " " " " "
19	" 14	" " "	124	6120	1249		135	" " " " " "
		1900.						
20	" 15	Dec. 15	120	4025	813		23	For beams made of gravel and sand — span 30″ — average breaking strength 2605, average modulus of rupture 525.
21	" 16	" 19	117.5	3950	800		31	
22	" 17	" 19	112	3650	737		31	
23	" 19	" 19	114	4200	851		31	
24	" 20	" 20	116	3470	699		28	
25	" 21	" 21	113	2965	594		27	
26	" 22	" 22	110	2800	560		26	
27	" 23	" 22	114	3210	645		27	
28	" 24	" 26	111	3175	638		26	
29	" 28	" 28	118	3720	750		22	
30	" 29	" 29	118	3365	676		23	
	1901.	**1901.**						
33	Jan. 22	Feb. 21	113	2700	539		24	For beams made of sand and broken stone — span 26″ — average breaking strength 3280, average modulus of rupture 571.
34	" 23	" 22	116	2250	444		23	
35	" 26	" 25	118	4503	913		30	

36	" 29	Mar. 1	110	Beams 6″ × 6″ × 30″.	3700	748	570 lbs. cement. 7.72 cu. ft. stone dust. 12.36 cu. ft. trap rock, 1′—2½″.	27	For beams made of sand and broken stone — span 30″ — average breaking strength 3347, average modulus of rupture 666. For beams made of stone dust and broken stone — span 30″ — average breaking strength 3874, average modulus of rupture 783.
37	" 31	" 2	113		4270	866		25	
39	Feb. 2	" 4	113		3560	718		23	
41	" 5	" 7	114		2930	587		28	
42	" 6	" 8	114		3460	697		27	
43	" 7	" 9	114		4230	834		30	
44	" 8	" 11	117		4110	832		29	
45	" 9	" 11	116		2830	565		28	
46	" 10	" 11	115.5		3510	705		27	
47	" 13	" 15	116		3690	744		30	
48	" 14	" 16	115		3600	726		29	
49	" 15	" 18	116		3430	690		28	
50	" 16	" 18	120		4430	898		27	
51	" 18	" 20	117		3450	694		30	
52	" 19	" 21	116		4620	938		29	
53	" 21	" 23	116		3110	624		27	
54	" 22	" 25	113		2320	460		26	
55	" 24	" 26	124		5100	1037		30	
56	" 26	" 27	115		4610	936		28	
57	" 28	" 30	115		3860	778		26	
58	Mar. 1	Apr. 1	118		3490	702		31	
59	" 2	" 1	114		3130	628		30	
60	" 4	" 3	116.5		4490	911		28	
61	" 5	" 4	116.5		4440	900		27	
62	" 6	" 5	119		4020	812		26	
63	" 7	" 6	116.5		4860	988		30	
64	" 8	" 8	114.5		3715	750		31	
65	" 9	" 8	121		5505	1121		30	
66	" 10	" 9	114		3810	770		29	
67	" 11	" 10	119		3870	781		28	
68	" 11	" 11	119.5		3295	661		28	
69	" 13	" 13	117		3180	638		26	
70	" 14	" 13	116		4575	929		30	

The concrete in each case was mixed by hand.

APPENDIX D.

REPORT OF PROFESSOR HENRY CARMICHAEL NOV. 2, 1900, ON SAMPLE OF CLAY FROM SECTION B OF THE EAST BOSTON TUNNEL, TAKEN OCT. 29, 1900, AT STATION 8 + 90, ELEVATION 74, WEIGHING 120 LBS. PER CUBIC FOOT.

"The sample of clay submitted by you October 29, has been analyzed with results as under:

Moisture	25.81	per cent.
Salt	0.37	"
Quartz, sand	3.29	"
Clay (by difference)	70.53	"

"NOTE. — The clay above determined was dried at 100 degrees C., and the water stated in the analysis does not include the water chemically combined in the clay. The clay is very plastic."

APPENDIX E.

CANVASS OF BIDS FOR FURNISHING LOAM IN PARK, MAVERICK SQUARE, EAST BOSTON. BIDS RECEIVED AUG. 21, 1900.

	Gow & Foss, 8 Exchange Pl.	M. S. Haley, 96 Maverick St., Chelsea.	National Contracting Co., 70 Kilby St.
200 cu. yds. loam to be hauled from storage and graded	$0 70 140 00	$0 60 120 00	Cost + 15% or $1.00 200 00
400 cu. yds. loam to be furnished and graded.	1 70 680 00	1 50 600 00	1 25 500 00
Totals	$820 00	$720 00	$700 00

APPENDIX F.

CANVASS OF BIDS FOR FURNISHING AND SETTING NEW CURBSTONE AND RESETTING OLD CURBSTONE AROUND PARK IN MAVERICK SQUARE, EAST BOSTON. BIDS RECEIVED SEPT. 4, 1900.

BIDDERS AND ADDRESSES.	Amount of Bid.
A. A. Libby & Co., 79 Milk street	$1,925 00
P. McGovern, 57 Maywood street, Roxbury	1,642 00
Gow & Foss, 8 Exchange place	1,507 74

APPENDIX G.

CANVASS OF BIDS, CHANGES IN SUBWAY NEAR PLEASANT STREET, SEPT. 4, 1900.

BIDDERS AND ADDRESSES.	4,000 Cu. Yds. Earth Excavation.	370 Cu. Yds. Old Concrete to be Removed.	Removing Steel Channels and Splicing 15 Posts.	280 Cu. Yds. Gravel Filling under Platform.	Laying 300 Lin. Ft. 12-in. Vitrified Pipe.	Laying 90 Lin. Ft. 6-in. Vitrified Pipe.	Laying 300 Lin. Ft. 4-in. Vitrified Pipe.	1,450 Cu. Yds. Concrete Masonry Port. Cem. Mortar.	Furnishing and Laying 70 Cu. Yds. Stone Masonry for Sidewalls.	Furnishing and Laying 27 Cu. Yds. Granite Coping on Sidewalls.	1,000 Sq. Yds. of Coating of Port. Cem. Mortar.	660 Sq. Yds. Waterproof Coating, Asphalt.	3,600 Sq. Yds. of Tarred Felt, Pitch, etc.	Totals.
	a	*b*	*d*	*e*	*f*	*2f*	*3f*	*ff*	*g*	*h*	*q*	*t*	*tt*	
W. H. Keyes & Co., Boston, Mass. ...	$2 40 9,600	$20 00 7,400	$334	$2 30 644	$0 60 180	$0 50 45 00	$0 40 120	$11 00 15,950	$22 00 1,540	$35 00 945 00	0 55 550	$0 35 231 00	$0 27 972	$38,511 00
Conners Bros., Lowell, Mass.....	2 35 9,400	7 50 2,775	 250	3 00 840	0 55 165	0 40 36 00	0 35 105	8 50 12,325	25 00 1,750	34 00 918 00	0 50 500	0 50 330 00	0 30 1,080	30,474 00
Metropolitan Cont. Co., Boston, Mass.	2 25 9,000	6 50 2,405	 511	1 61 450 80	0 25 75 00	0 25 22 50	0 25 75 00	9 00 13,050	26 00 1,820	42 00 1,134	0 50 500	0 35 231 00	0 25 900	30,174 30
National Contracting Co., New York...	1 60 6,400	5 00 1,850	 500	1 80 504	0 20 60	0 12 10 80	0 10 30 00	9 50 13,775	25 00 1,750	40 00 1,080	0 30 300	0 30 198 00	0 15 540	26,997 80
Patrick McGovern, Roxbury, Mass...	1 97 7,880	9 60 3,552	 350	1 25 350	0 35 105	0 25 22 50	0 20 60 00	7 25 10,512 50	19 00 1,330	35 50 958 50	0 35 350	0 30 198 00	0 10 360	26,028 50

APPENDIX H.

CANVASS OF BIDS FOR BUILDING PIPE SEWER AND TWO MANHOLES, TO GIVE OUTLET TO SUMPS NEAR STATION, BOYLSTON STREET AND COMMON. BIDS OPENED JAN. 3, 1901.

BIDDERS AND ADDRESSES.	200 Lin. Ft. 10-in. Pipe Sewer.	113 Lin. Ft. 8-in. Pipe Sewer.	1 Cu. Yd. Concrete removed and disposed of.	40 Sq. Yds. Portland Cement Mortar.	18 Sq. Yds. Water-proof Coating (Asphalt).	4 Cu. Yds. Brick Masonry.	1.6 Cu. Yds. Concrete furnished and put in place.	Time of Beginning. 1901.	Time of Completing. 1901.	Totals.
Patrick McGovern, 57 Maywood street, Roxbury	$1 75 350 00	$1 75 197 75	$25 00 25 00	$0 70 28 00	$0 50 9 00	$23 50 94 00	$12 00 19 20	Jan. 7	Jan. 19	$722 95
Charles G. Craib, 138 Pleasant street, Winthrop	1 50 300 00	1 25 141 25	5 00 5 00	0 50 20 00	0 20 3 60	16 00 64 00	10 00 16 00	Jan. 7	Jan. 19	549 85
Gow & Foss, 8 Exchange place, Boston	1 15 230 00	0 80 90 40	25 00 25 00	0 60 24 00	0 50 9 00	16 00 64 00	8 00 12 80	Jan. 7	Jan. 26	455 20

Pipe and asphalt furnished by the Commission.

APPENDIX I.

CANVASS OF BIDS FOR TWO SUB-PASSAGEWAYS IN SCOLLAY SQUARE STATION OF SUBWAY, APRIL 25, 1901.

BIDDERS AND ADDRESSES.	310 Cu. Yds. Earth Excavation.	70 Cu. Yds. Concrete Removed.	180 Cu. Yds. Concrete Masonry Portland Cement Mortar.	340 Sq. Yds. Plastering of Portland Cement Mortar.	340 Sq. Yds. Waterproof Coating, Asphalt.	2 Tons Iron and Steel Set in Place and Secured.	20 Lin. Ft. 6-in. Akron Pipe.	20 Cu. Yds. Brickwork.	Supporting and Protecting Tracks, Buildings, etc.	TOTALS.
	a	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	
Frank A. Foster & Co., 34 School street, Boston ...	$5 00 1,550 00	$15 00 1,050 00	$12 00 2,160 00	0 80 272 00	$0 60 204 00	$25 00 50 00	$1 00 20 00	$25 00 100 00	$3,000 00	$8,806 00
George H. Foss, 8 Exchange place, Boston....	2 75 852 50	15 00 1,050 00	10 00 1,800 00	0 60 204 00	0 45 153 00	25 00 50 00	0 75 15 00	18 00 360 00	750 00	5,234 50
Patrick McGovern, 57 Maywood street, Roxbury ...	2 50 775 00	12 00 840 00	10 00 1,800 00	0 50 170 00	0 40 136 00	20 00 40 00	0 50 10 00	18 00 360 00	550 00	4,681 00
Metropolitan Contracting Co., 95 Milk st., Boston.	2 65 821 50	8 00 560 00	10 00 1,800 00	0 50 170 00	0 35 119 00	7 00 14 00	0 50 10 00	18 00 360 00	25 00	3,879 50

APPENDIX J.

CANVASS OF BIDS FOR RIBBED TILE IN TWO SUB-PASSAGEWAYS IN SCOLLAY SQUARE STATION, SECTION 7, SUBWAY. BIDS RECEIVED MAY 13, 1901.

BIDDERS AND ADDRESSES.	280 Sq. Yds.		Price per Sq. Yd. for Setting.	Amount.	Total Amount.	Work to be	
	Price Bid.	Amt. of Bid.				Begun.	Completed.
National Fireproofing Co., Pittsburg, Pa.	.405	$124 74[1]	$1 20	$336 60	$460 74	On 24 hours notice	2 working days
Wm. H. Smith, 2A Park street, Boston	To be furnished by the Commission.	124 74	99	277 20	401 94	....	About 1 week.
M. J. Fitzgerald, Somerville	To be furnished by the Commission.	124 74	70	196 00	320 74	....	4 days and nights, Sundays included.
M. J. Fitzgerald, Somerville	To be furnished by the Commission.	124 74	45	126 00	250 74	....	4 or 5 days.

[1] 10 per cent. added for breakage.

APPENDIX K.

CANVASS OF BIDS FOR FURNISHING AND SETTING IN PLACE ENAMELLED CLAY TILE FOR TWO SUB-PASSAGEWAYS IN SCOLLAY SQUARE STATION OF SUBWAY. BIDS RECEIVED MAY 14, 1901.

BIDDERS.	Kind.	Price per Yd. for 180 Sq. Yds. on Walls.	Price per Yd. for 40 Sq. Yds. on Ceiling.	Amounts.	Total Amount.	Time of	
						Beginning.	Finishing.
Waldo Brothers, 102 Milk street	3 in. × 6 in. clay	Not stated	Not stated	....	$1,603 80[1] 1,247 40	Not stated	Not stated
M. J. Fitzgerald, Somerville	3 in. × 6 in. clay	$5 09 6 75	$5 09 6 75	$1,119 80 1,485 00	1,119 80 1,485 00	Not stated	4 or 5 weeks, June 5, 1901
Grueby Faience Co , 2A Park street	3 in. × 9 in. Grueby	6 30	.... 7 65	1,134 00 306 00	.... 1,440 00	Not stated	Not stated
Grueby Faience Co., 2A Park street	3 in. × 6 in. clay	4 95	.... 6 75	891 00 270 00	.... 1,161 00	Not stated	Not stated
W. H. Smith, 2A Park street	3 in. × 6 in. clay	4 95	.... 6 75	891 00 270 00	.... 1,161 00	Not stated	1 week for each passageway

---

[1] Working night and day.

APPENDIX L.

CANVASS OF BIDS FOR FURNISHING AND PUTTING IN PLACE IN TWO SUB-PASSAGEWAYS IN SCOLLAY SQUARE STATION, SECTION 7, SUBWAY, ARTIFICIAL STONE, SAFETY TREAD, AND FENCE AROUND OPENINGS. BIDS RECEIVED May 14, 1901.

BIDDERS AND ADDRESSES.	American Mason Safety Tread.	Universal Safety Tread.	Northerly Passageway Work to be		Southerly Passageway Work to be	
			Begun.	Completed.	Begun.	Completed.
Aberthaw Construction Co., 7 Exchange place, Boston	$1,127 00	No bid.	48 hours after notification.	Not stated.	48 hours after notification.	In 12 days.
Simpson Bros., 166 Devonshire street, Boston	1,078 00	$1,142 00	24 hours after notification.	In 8 days.	24 hours after notification.	In 8 days.
W. A. Murtfeldt Co., 166 Devonshire street, Boston	800 00	No bid.	36 hours after notification.	In 10 days.	48 hours after notification.	In 10 days.

APPENDIX M.

Canvass of Bids for Furnishing and Setting in Place Opalite Tile in Two Sub-Passageways, Scollay Square Station. Bids received May 20, 1901.

Bidders and Addresses.		Price per yd. for 180 sq. yds. tile for side walls.	Price per yd. for 40 sq. yds. tile for ceiling.	Amounts.	Totals.	Work to be	
						Begun.	Completed.
Grueby Faience Co., 2A Park street, Boston	Sample "B" 4½ in. × 9 in.	$5 40	$6 75	$972 00 270 00	$1,242 00	Not stated.	Not stated.
	Sample "A" 3 in. × 6 in.	4 50	6 05	810 00 242 00	1,052 00	"	"
Wm. H. Smith, 2A Park street, Boston	Sample "B" 4½ in. × 9 in.	5 32	6 60	957 60 264 00	1,221 60	"	One week for each passageway.
	Sample "A" 3 in. × 6 in.	4 32	5 85	777 60 234 00	1,011 60	"	

APPENDIX N.

CANVASS OF BIDS FOR FURNISHING AND SETTING IN PLACE TWO GRANITE POSTS WITH BASES, ON CONCRETE FOUNDATION, AND SIX FEET, MORE OR LESS, OF GRANITE CURB AT EAST BOSTON TUNNEL INCLINE, AND ONE GRANITE POST AT THE SUBWAY INCLINE, HAVERHILL STREET, NEAR TRAVERS STREET. BIDS RECEIVED AUG. 8, 1901.

BIDDERS AND ADDRESSES.	Amount of Bid.	Time of	
		Beginning.	Completing.
S. and R. J. Lombard, Charlestown	$452 00	Not stated.	Not stated.
Cambridge Co-operative Granite Co., Cambridge	400 00	At once.	Sept. 15, 1901.
Walter S. Lyons, Roxbury	397 00	Aug. 10, 1901.	Sept. 1, 1901.

APPENDIX O.

CANVASS OF BIDS FOR FURNISHING AND ERECTING IRON FENCE: 300 FEET ON COPING OF EAST BOSTON TUNNEL INCLINE, MAVERICK SQUARE; 285 FEET ON COPING OF EASTERLY SIDE OF NORTHERLY INCLINE OF SUBWAY, NEAR TRAVERS STREET. BIDS RECEIVED AUG. 14, 1901.

BIDDERS AND ADDRESSES.	No. of Pounds as Estimated.	Price per Pound.	Amount of Bid.	Time of	
				Beginning.	Completing.
G. W. & F. Smith Iron Co., Gerard street, Roxbury	35,090 lbs.	$.076	$2,667 00	Not stated.	Not stated.
New England Structural Co., Boston...	29,300 "	.08	2,344 00	"	"
Van Dorn Iron Works Co., Cleveland, Ohio	40,280 "	.055	2,215 40	On approval of contract.	85 days from award.

APPENDIX P.

CANVASS OF BIDS FOR LAYING PIPE SEWER AND BUILDING THREE MANHOLES IN STATE STREET, NEAR ATLANTIC AVENUE. BIDS RECEIVED AUG. 15, 1901.

BIDDERS AND ADDRESSES.	125 ft. 18.-in. Pipe Sewer.	6 Cu. yards Brick Masonry.	Total.	Time of	
				Beginning.	Completing.
Dorchester Construction Company, Dorchester, 119 Boston street	$2.85 356.25	$19.90 119.40	$ 475.65	Not stated.	Not stated.
P. McGovern, Roxbury, 57 Maywood street	1.50 187.50	18.00 108.00	295.50	"	"
G. H. Foss, Boston, 8 Exchange place	1.15 143.75	16.00 96.00	239.75	Aug. 18, 1901	Aug. 25, 1901

NOTE. — Pipe furnished by the Commission.

3 2044 029 330 388

DATE DUE

DEC 2 3 1987 1987 DEC

HE
4491
B65.1
1901
c.2